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Plastics

EALING WITH THE MANUFACTURE USES AND POTENTIALITIES OF PLASTIC MATERIALS

LIGHT

WITHOUT RISK

The photograph shows a laylight fitted in the central control room of an important public service. The interesting point is that the translucent material is not glass but SUPER-ARMOURBEX—strong Bexoid made stronger still with half-inch steel wire mesh. Such lights are proof against accidental damage in times of peace—they are proof against concussion, air-blast and small splinters in time of war. Specify Super-Armourbex for windows, skylights, laylights in important buildings. Write to us for further particulars of the many BX materials of use in A.R.P. work.

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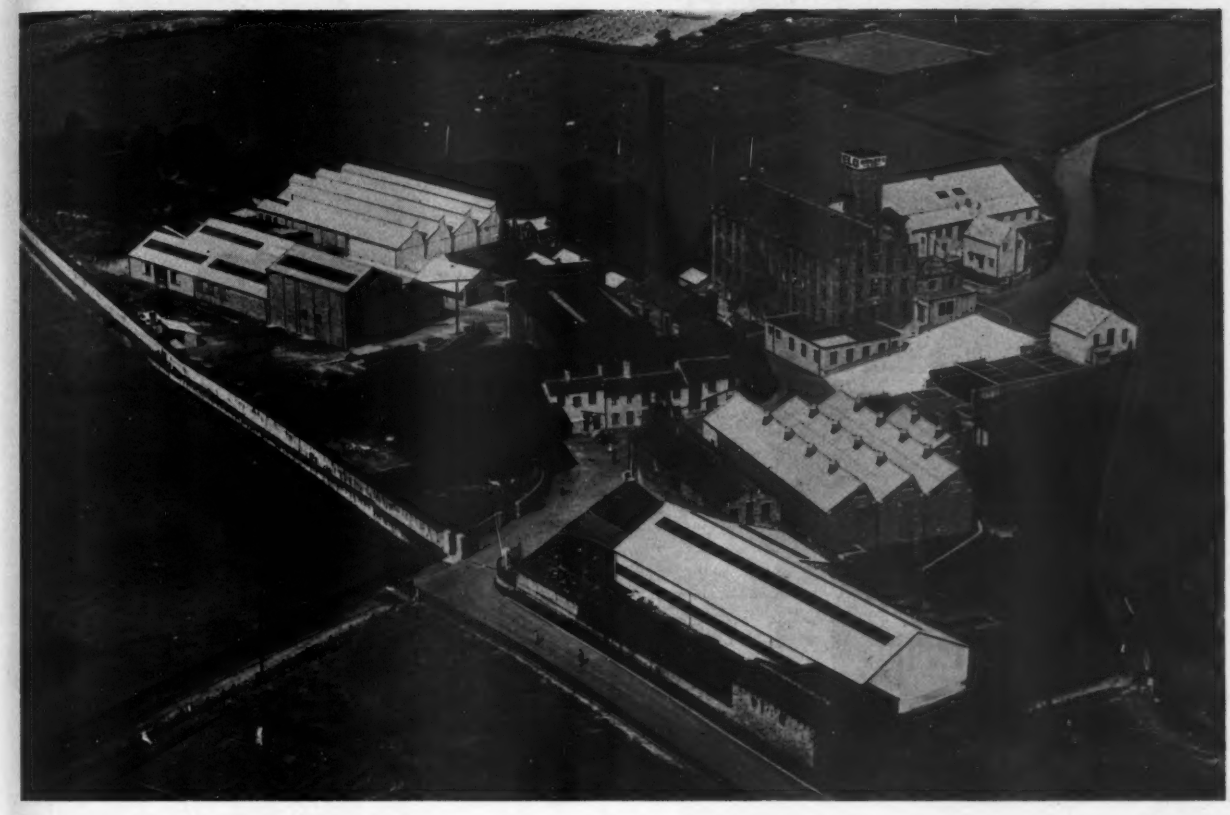
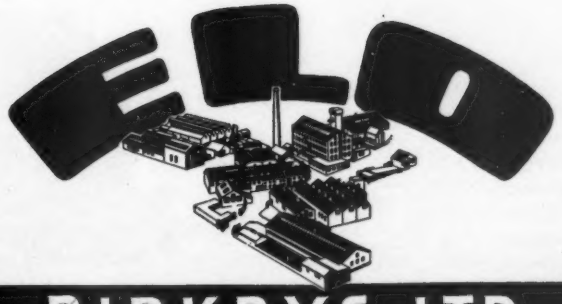


Aerial photograph *August, 1938*



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BRITISH PATENT Nos. 386,083 — 386,895 — 467,814 — 468,679 — 468,744—others pending.

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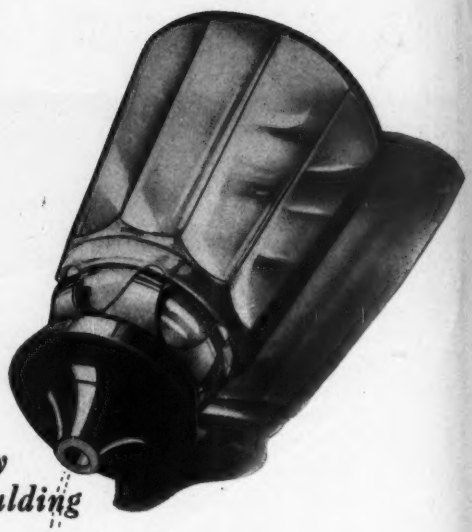

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NACROLAQUE Mother of pearl

RHODIALINE Transparent material 2/10 to 10/10 mm. in continuous reels

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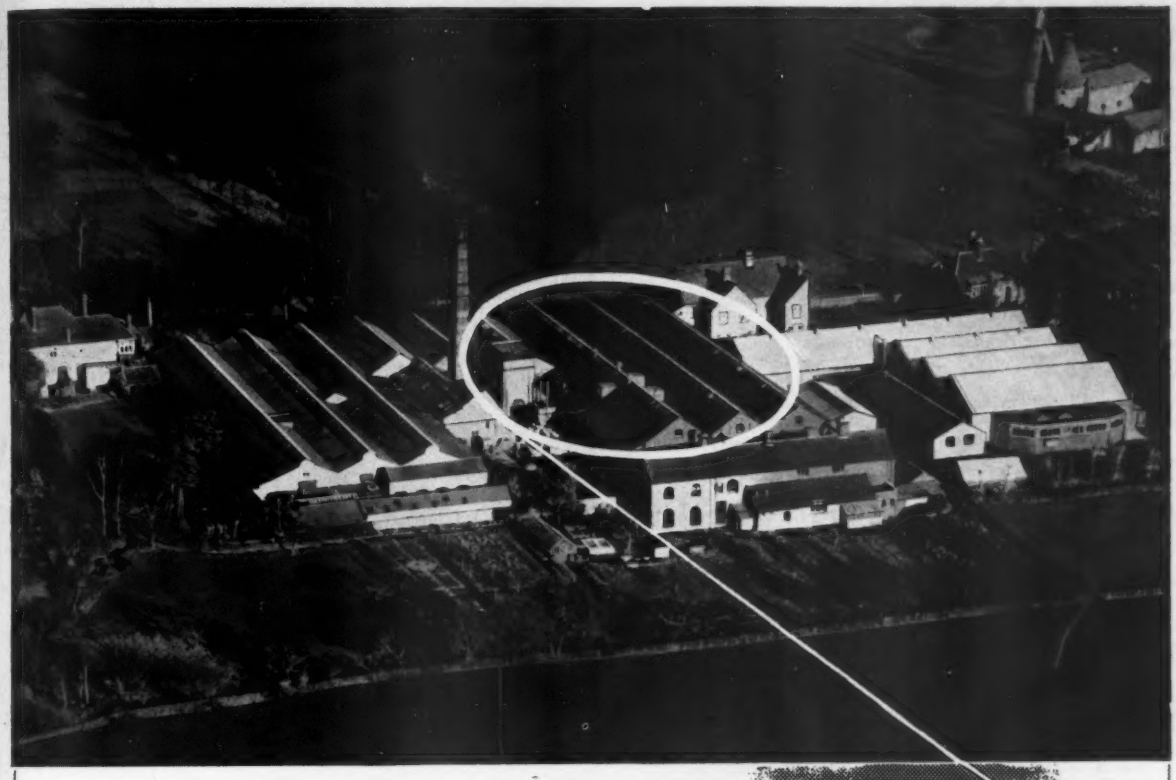

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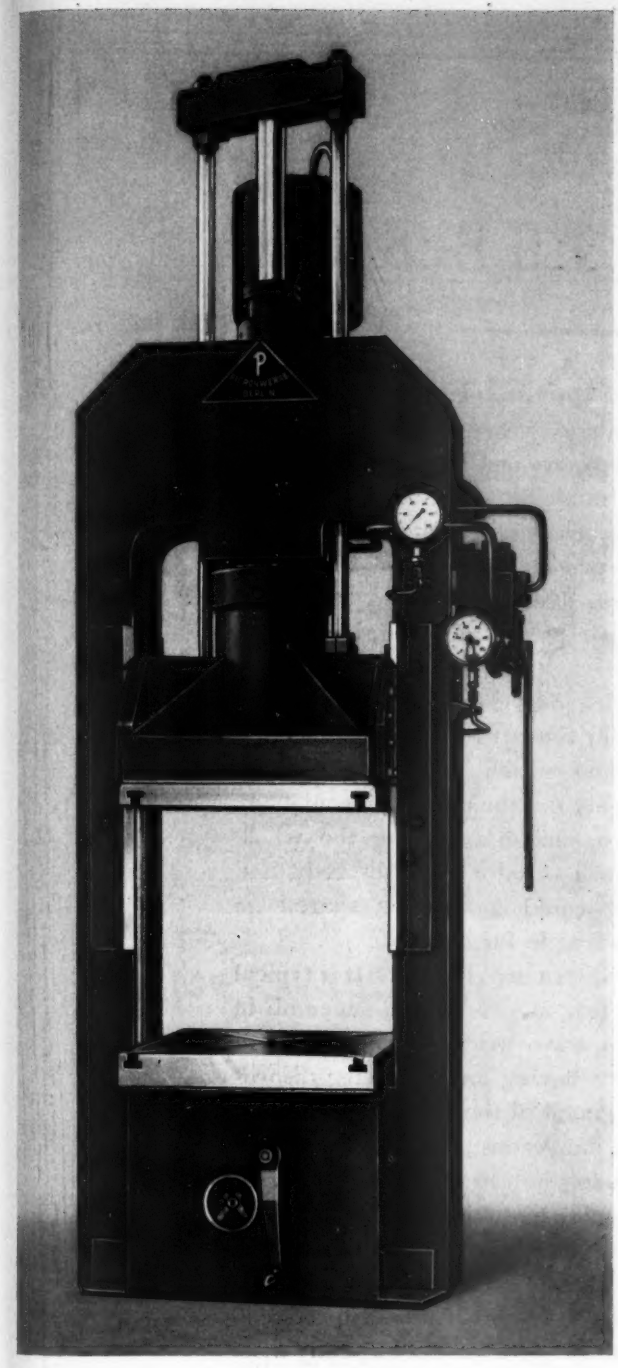

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SPOILING THE SHIP

Some time ago, a leading manufacturer of plastics was asked to quote for a biggish run of mouldings. When he got the estimate the buyer shook his head. "You are not only out," he said, "but you're right out. There must be some mistake." The manufacturer looked into the figures again and said, "No, that is the price and a pretty keen price at that," and, of course, the order was placed elsewhere. Two years later, the buyer rang up and asked whether their price still stood, because, if so, they could have the order.

It took that buyer two years to learn the lesson that the novelty of plastics is no compensation in the eyes of the public for a shoddy article; that a moulding which doesn't do its job properly is just plain bad business. But the point is, if somebody hadn't been prepared to make such a moulding the whole plastics industry would have been saved a lot of discredit and some thousands of the public could have been spared an impression that plastics are too fragile for the job.

Do you think this is an isolated instance? It is not. It is typical of the tendency today. And a few moulders who succumb to the temptation to work down to a low price at the expense of a sound standard of quality are having an altogether disproportionate influence on the judgment of the public.

As a policy it is shortsighted and dangerous; a policy that, were it to continue, would bring a young industry into disrepute. So let us look to it that every moulded article we produce is of adequate strength, that it is suitably designed and well finished —and thus convince the user that plastics are a remarkable contribution to the materials of everyday life. Soundly produced mouldings have a tremendous future—so let us not be penny wise.

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Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials.

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Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials

Proprietors - - TEMPLE PRESS LIMITED
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Editor - - M. D. CURWEN, B.Sc., A.I.C.
Offices - 5-17, Rosebery Avenue, London, E.C.1

Petroleum as Raw Material

DURING the past 15 or 20 years petroleum has been the subject of much chemical research, quite apart from its use as a fuel, and it has for some time been regarded as the future raw material for a host of chemicals, some of which may affect profoundly the economics of the world.

It has been converted by chemical action into acids, which, in turn, by reaction with glycerine, can be made into fatty oils, suitable, at least from the scientific aspect, as edible oils and butter-like foods. By similar reaction it can be made into drying oils, which, like linseed oil, can be used for making paints and lacquers. Special alcohols are already on the market for chemical work and their combination with acids provide special liquids valuable for compounding with plastics. And since from all petroleum it is possible to produce cracked gases, very reactive in nature, a large number of plastics are within the reach of the chemist.

The latest news from the petroleum world is that Dr. G. Egloff, the well-known chemist of the Universal Oil Products Co., has discovered a new method of making synthetic rubber from butane gas. This gas is normally present in the natural gas that issues from the ground in Canada and other places in the world and is used as a heating and illuminating medium. The butane gas can be separated from the natural gas and, under pressure in the form of a liquid, is sold in France and Great Britain under the name of Butagas and Calorgas where town's gas cannot be economically piped. It is made in Great Britain by cracking by Imperial Chemical Industries, Ltd., and is also imported into this country from France and Poland. The new process of making synthetic rubber from this gas, presumably by cracking and then polymerization, is not only economically important, but also scientifically interesting, for Dr. Egloff reports that his product is cheaper and better than the Buna rubber made in Germany. It would, he says, be as cheap as pure Para rubber if made in quantity, and it possesses high resistance to heat, acids and alkalis. As for quantities, there is so much butane available that the oil industry could make 5,000,000 tons annually.

At present the natural rubber-growing industry is almost entirely in the hands of the British and the Dutch. It can readily be realized that it is now, theoretically, at any rate, within the power of the United States or, for that matter, any other scientific nation rich in oil, to be quite independent of outside sources and, indeed, to swing the balance of this trade in other directions.

The fact that synthetic rubber is not as good or is better than the natural variety is not of tremendous importance under certain conditions. Tyre manufacturers may to-day guarantee their products to last 20,000 to 30,000 miles, but it is only some few years ago that none of them would have been willing to guarantee them for more than 10,000 miles, and, generally speaking, the customer was quite content with what he got. If a nation is determined to be self-supporting on a synthetic rubber somewhat inferior to the natural material it is difficult to see any real hardship, if other economic advantages accrue. It is also by no means certain that synthetic rubber is inferior in wearing qualities. From other points of view, some synthetic rubber-like materials are much better than the natural material.

Butane rubber would possess one distinct advantage in addition to those technical ones claimed by Egloff over the German Buna rubber, which is made from alcohol. There is little likelihood of any diminution in the availability of butane in any crisis, whereas alcohol is economically a dangerous material to use as a basic raw material for large-scale manufacture in times of war. There are limits to the quantities that can be manufactured from home-grown materials and it becomes one of the most important of war chemicals for explosives and medicinal production. Both of these get first call in war time, and we believe the German synthetic-rubber industry has already slowed down during the past year from this cause.

From the point of view of this country, there seems little reason why we should produce synthetic rubber in peace time, in view of the cheap natural rubber we grow. There is a strong argument in favour of making some proportion of special synthetic rubbers which are superior to the natural variety. It also seems incongruous to build industries in war time that would be of little use in peace time.

There is also one interesting sidelight on the manufacture of everything within the borders of a country to make it self-contained in war time. So many will be needed for the manufacturers that there will be no soldiers available to fight.

Plastic Milk Bottles

SO many readers in this country and abroad have been interested in the notes we published on this subject and the development that has taken place, that we feel constrained to give them whatever news is available from time to time.

It may be remembered that we were very enthusiastic about the idea of replacing the glass bottle for one of non-brittle thermoplastic material, such as cellulose acetate. The use of containers made of the latter material would eliminate costly and dangerous breakages, do away with collection charges and also the washing and sterilization of used bottles, which must now be done by mechanical means. If any of our readers have seen the enormous mechanical bottle washing plants that exist in our milk filling plants (similar ones are, of course, installed in beer bottling works) they will readily agree that it is more often an incubus than an aid to the industries concerned and that most works managers regard bottle washing as a nightmare. Thus the non-returnable bottle of plastics, which could be discarded by the housewife with no danger, was considered an advance on the foregoing practice.

Judge our amazement, therefore, to receive a letter from a reader interested in the process. It includes the following sentence: "They . . . still have to make a plastic . . . that will withstand boiling; at the moment cellulose acetate will not stand the scalding that the bottles must go through." This means, of course, that the plastic bottle will be collected after use, returned and washed. This is a considerable disappointment, if it be true, and upsets considerably the original sensible scheme. Presumably, cost necessitates re-washing.

Your Problems

ONE of the most popular features in this journal is undoubtedly the correspondence pages, wherein readers may get replies, if we know the answers, to their everyday problems. It is generally the most popular in any journal, especially of the technical type, for we are all inquisitive about other people's worries. Those worries may also be our own, or somewhat akin to them.

The problems presented to us have varied widely from mere requests of trade names to names of manufacturers of certain products, to technical problems on processes or suggestions as to suitability of plastics for special purposes. Some have been purely chemical, others apparently quite outside the range of plastics, but obviously they have been put to us by those who have general industrial problems too. All such matters we are delighted to help with, and we hope readers will keep on submitting them. Obviously, some of the questions, if complicated, cannot be answered quickly and a considerable time may elapse before information can be collected. Readers will give us their indulgence.

It has always been our desire to answer one very common question in the lines of these editorial notes. The inquirer usually asks his question and then adds, ". . . or could you inform me where such information can be obtained?"

We desire to boost a rather gloomy-looking building off Chancery Lane, London—the Patent Office and its library.

If the question is technical and does not require mathematical or other calculations, or is not of the type "How much money do I need to start a plastics factory?" which is almost the same as asking, "How long is a piece of string?" then we should say that 99 out of 100 times the answer lies within the walls of the Patent Office.

Details of patents, trade names, almost every reputable technical journal in any subject and in any language, almost every technical book that has ever been published, whether it is on making explosives or concrete or diamond polishing or hazards in industry or anything—they are all there. As for indexes to technical subjects, perhaps the most comprehensive is the annual Industrial Arts Index, from which references to any subject, discussed or written about in the preceding year, can be obtained. The British Chemical Abstracts and the American Chemical Society's Abstracts are almost as useful in finding references to all industries which have chemical problems—there are extremely few that have none.

A.R.P. Plastics

WE have received an extremely interesting article, which we shall publish in August, on the utilizing of rubber latex as a backing to windows to prevent them being shattered. The latex being in the form of a thin cream suitably stabilized can either be sprayed on to the window by the ordinary technique of a paint spraying gun, or, simpler still, since perfect surfaces are not required, painted on by means of a brush.

The photographs of the results obtained by ball-dropping tests and also by heaving brick-bats through the windows so treated reveal the extraordinary adhesion and strength of the rubber film. Naturally enough, a heavy brick thrown with considerable velocity makes a hole, but although the remainder of the window is cracked the pieces are held in place so that there are no flying splinters to do damage.

These remarkable results (comparative photographs show the superiority of rubber film over the mere covering of paper advised by A.R.P. authorities) are important, since latex is relatively cheap and can be applied by the ordinary public if properly stabilized and directions are carefully followed. It can be supplied in translucent or black form suitable for blacking out lights.

This subject raises the interesting theory that rubber latex, if the dried film were transparent enough, might be suitable for spraying the inside of motor-bus side windows. At present there is no obligation to provide safety glass for these, although there is an obligation to provide it for the front windows. Obviously, the high cost of the sandwich type of safety glass militates against its general use, but it does not appear to be outside the bounds of economic possibility to spray, say, once a month, a thin film of latex.

It is also not impossible that an ordinary cellulose lacquer film sprayed on to the windows would have a reasonably good effect.

British Plastics Federation.

MAJOR S. M. MOHR, O.B.E., M.C., M.I.E.E., was elected chairman of the British Plastics Federation at the fifth annual general meeting held on June 6. Mr. H. W. Graesser-Thomas was elected vice-chairman.

Major Mohr has long been concerned with plastics, especially in regard to their employment in the electrical industry, for as early as 1920 he was sales manager of Micanite and Insulators Co., Ltd. He is now managing director of that concern.

The Engineer Looks at Plastics

TO-DAY the engineer may take two views of plastics. One is something like this: "Yes, plastics are interesting, but we will wait until they are stronger." The other is: "Let us design our parts now to compensate for any weaknesses plastics may have, and obtain their advantages to-day." The former view may be either lazy or over-cautious, but the result is that the engineer with this attitude may be missing definite advantages which plastics could bring to his product.

The advantages obtainable with plastic materials may be divided into two groups. The consumer advantages include light weight (half the weight of aluminium); a chip-proof, scuff-proof lustre; non-resonance; non-conductance of electricity; pleasing-to-touch surface; and resistance to peeling, checking, moisture, heat, acids, alkalies and greases—all "talkable" and providing material for the sales department.

The engineering advantages are self-insulation; lower shipping weight; elimination of grinding, spraying and baking operations; reduction of finish rejections and damage to finish in shipping; and, when the quantities are sizable, production economy—all of which may result in lower costs. In many instances, such as in the Hoover cleaner, for example, there are both lower production costs and convincing sales arguments—an excellent formula for profits.

Engineers planning their first structural uses of moulded plastics must keep certain fundamental facts in mind, for while plastics have joined the basic-material group, they cannot be handled like metals. The impact strength of even the stronger phenolic plastics is considerably below that of aluminium or magnesium alloys, and the tensile strength is about one-tenth that of stamped steel. Hence, it is evident that a different approach must be adopted if one is to obtain successful moulded structural parts. Different shapes of greater inherent strength should be used, wall thicknesses should be greater and unsupported sections should be reinforced. A list of hints for designers of structural plastic parts follows:—

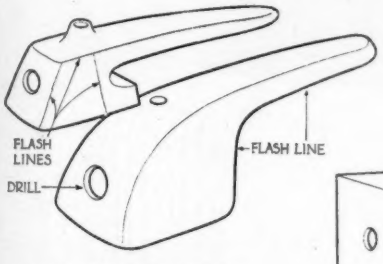
Use corner fillets and filleted inside ribs on heavy-duty housings. Put attachment inserts at filleted corners of boxlike shapes, if possible, thus strengthening the piece and keeping flowmarks where they show the least. Allow extra wall thickness at stress points or use reinforcing ribs or beads. Use domed shapes instead of flat-topped forms, because they are stronger owing to the fact that impact stresses are more widely distributed.

Fillet inside corners and "break" outside corners to aid the flow of material in the mould. This contributes to the strength. Also cleaning of food-equipment parts, for instance, is facilitated. Provide large radii. as these give greater strength than sharp corners and make for ease of moulding. Check carefully with your moulder and material supplier to get the compound best suited in strength and other properties to your application.

Many other rules could be included for specific problems, but when engineers follow these general hints, plus their own common sense, successful plastic mouldings usually result. One cannot, however, under-estimate the importance of getting the proper moulding material, for careful selection of compounds has made several jobs successful that were considered impracticable by other manufacturers. To show some of the varieties of phenolic moulding materials available, the major groupings of one supplier are listed:—

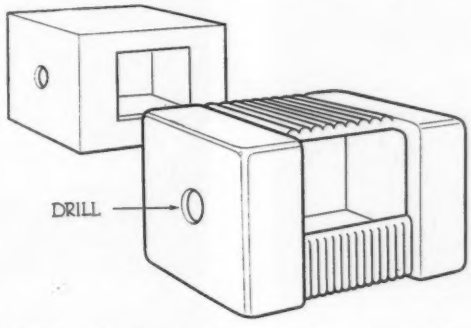
General purpose.	Closure type.
Non-bleeding.	Moisture-resistant.
Heat-resistant.	High dielectric.
Extrusion type.	Acid-alkali-resistant.
High impact.	Friction-resistant.
Arc-resistant.	Sanding, buffing type.

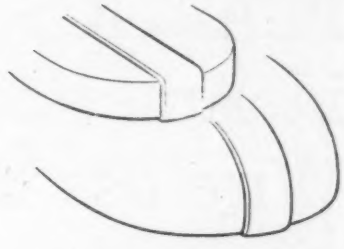
A classic example of how careful design produces more successful mouldings is furnished by a manufacturer of telephones, who experienced some breakage of the hand-set arm when dropped on concrete floors. Redesign was decided upon, several parts were eliminated and weak sections were strengthened by a rib blended into the design. In the new experimental mould it was found that the high-impact phenolic compound formerly used was not necessary, and that a less expensive, but more glossy, material could be used. The result was a stronger, cheaper telephone set.



Avoid shapes like this that call for loose sections in the mould to accomplish under-cuts. Extra flash lines mean extra finishing cost and slow operation.

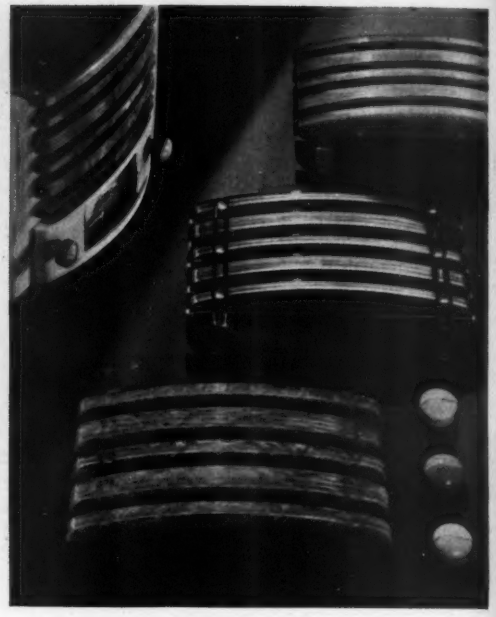
To cut costs, small side holes can often be drilled and large ones continued to the top, to draw straight. Ribbing can be used to hide possible flow marks under hole.





Domed or hemispherical shapes are stronger than flat-topped shapes in plastics, because stresses are distributed more widely. Danger of warping is reduced, too.

Recent design of Detrola in ivory Plaskon with black feet and knobs.



Tenite (cellulose acetate) grilles used on a "urea" cabinet for contrast.

PLASTICS in American Wireless Sets

The wide-spread use of plastics for radio cabinets in the U.S.A. and the designs displayed here arouse the question, "Why are not British manufacturers more venturesome?"

American Insulator Corp. moulded this "Silvertone" cabinet from ivory Beetle.

MOST of the modern plastics were young when the American radio industry was born, hence it may be said that plastics have grown up with the radio. In any event, radio manufacturers have used plastics in one or more forms from the start. The manner in which plastics are employed in to-day's radios, it may be noted, differs in many respects from that characteristic of early models. Early radios, for example, employed laminated plastic fronts, but the latter have given place to metal fronts on most commercial receivers and to wood or moulded plastics in modern receivers for home use. Many American home receivers, especially types for table and desk use, have their cabinets moulded in one or more pieces and, of course, present a materially better appearance than earlier box-like cabinets.

To-day, the American radio cabinet intended for moulding from plastics is, as far as external appearance is concerned, the work of artists skilled in industrial design. Such designers are likely to be given approximate internal or overall dimensions and the location of openings and tuning devices and then are left to work out a design which is pleasing to the eye and well proportioned. In general, simple lines have replaced earlier and more ornate types and there appears to be a tendency toward plain colours rather than mottled effects supposed to simulate wood, although the latter are still used.

Having decided on a general appearance such as is expected to gain public favour, experienced manufacturers are likely to submit the design to moulders who may be called upon to produce the cabinet so that troubles and unnecessary expense in mould construction and moulding may be avoided. This is an excellent practice and, although it may result in detail changes, especially if the designer does not fully understand the problems of the moulder, these may not affect appearance at all or may change it, perhaps, with the co-operation of the original designer, so little as to retain all original essential features. Disregard of the moulder's advice is likely to result in higher costs and perhaps in breakages otherwise avoided.

Early American moulded cabinets were mostly made in one piece and were materially larger than the average moulded cabinet of to-day. There was then a season or two in which several cabinets were moulded in three or more pieces. This made it possible to employ a wide range of colour combinations, often involving two or more types of plastic, such as one for the body, another for the front or cover and perhaps a third for the grille. Although some of the results secured by this means were considered attractive and were commercially successful, mould cost was inclined to be higher, as more than one mould was needed, and it was soon found that at least equally good results could be secured,

A Fadalette cabinet in lovely onyx Catalin, the cast resin, which is available in many colours.

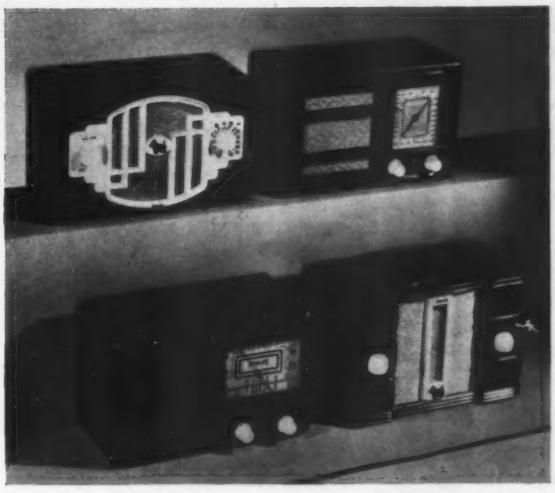
usually at lower cost, by reverting either to a one-piece cabinet or to one made in a single piece except for a separately moulded grille. There are several successful designs of this type on the market at present and the simplicity and unity of design in one colour or with only the grille and fittings varied is generally realized.

Detrola cabinet moulded in black Bakelite. The dial and knob are in contrasted acetate.

During the evolution just described, developments in smaller tubes and in other components of correspondingly smaller size has made it possible to employ chassis of reduced size and to use considerably smaller cabinets. There is thus available to-day a large number of small sets in which plastic cabinets quite moderate in cost are employed.

Another change which has altered details of design and general appearance is the application of devices for tuning by the use of a series of buttons, usually supplemented by a dial tuning device or its equivalent. Plastic cabinets can be adapted readily to such changes, but this has usually required either extensive alterations in moulds or new moulds for the cabinet and frequently one for buttons of a special size and shape. The net result has been rather to favour than to operate against the use of plastics and, in the case of console cabinets of larger size, which are produced in wood, the use of plastic units for control elements has been generally accepted for both old and new ideas. Even when cabinets too large to be moulded readily are required, the permanence of plastics, their pleasantness to the touch and their adaptability to production in convenient shapes have often dictated their use for control knobs, buttons, and sometimes bezels, as well as for dials in which latter translucency is desirable if not essential.

Although many small moulded cabinets still marketed have open-work grilles, usually backed by fabric which hides interiors, there are now several designs in which louvres have taken the place of grille bars. This change



Remler radios of dark coloured Durez. Light coloured grilles and knobs of "urea" resin or acetate.

makes it possible to do away with grille fabrics, as the openings below the louvres are hidden when the cabinet is viewed in a position below eye level, as in normal service. A proper use of louvres helps to simplify the design and often to improve appearance. It may or may not simplify production, depending upon which specific designs are compared and just how louvres are made. In a good design, louvres provide ample ventilation, are easy to keep clean and save the use of fabrics and their application to the finished cabinet.

In one recent and quite popular design, the moulded cabinet is offered in school or college colour and with a separately moulded grille embodying the complementary colour. Such combinations appeal to a fairly large class of purchasers but require a large variety of colours, including some difficult to match in the mutual colours of plastic and rather high cost even when available. To meet this situation the cabinets are moulded

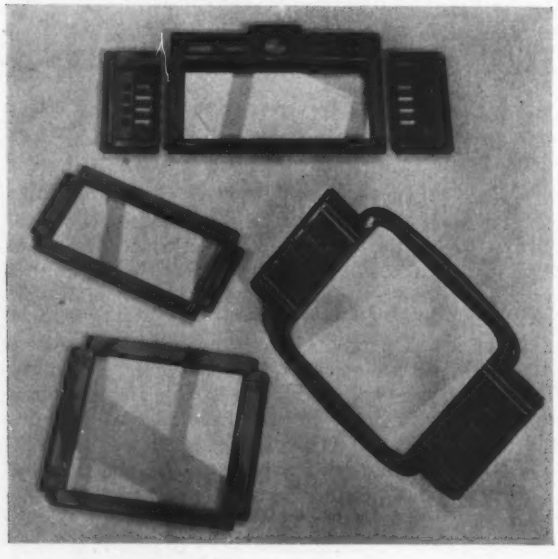
e

Group of cabinets, some of which are moulded in more than one piece. Those in dark colours are moulded in Durez phenolic materials and those in light colours from Plaskon urea plastic.

in black phenolic plastic and then are enamelled by a spray method to yield the desired colour. The colour presumably is baked on and selected for good adherence, but does not offer the degree of permanence provided by the usual plastic without finish. This cabinet and many others, however, are available in ivory and/or other light tints of translucent urea which require no finish, as well as in the standard black or mottled phenolics also needing no applied finish.

Phenolic and urea plastics, besides coming at the low end of the cost scale in the family of plastics, have the advantage of setting to permanent shape when moulded and so are not affected by the heat generated within the radio set, assuming, of course, that they are properly cured when moulded. General-purpose phenolics with wood flour filling, although lowest in cost, are rather brittle for cabinet mouldings. This has given rise to the use of grades having higher impact strength and containing either cotton flock or some other filler-adding fibres which strengthen the product. Urea cabinets are usually moulded in ivory tints and are somewhat higher in cost than the phenolic type which are confined to black and dark colours, except when enamelled. Translucency adds to the beauty of the urea cabinet and the fact that it contains alpha cellulose filler adds to its strength.

Although cabinets could be moulded from cellulose acetate, which is high in impact strength and available in many beautiful colours, costs of the material are higher than for moulded phenolics and ureas, and the material, being thermo-plastic, softens if heated to the temperature which may be attained in a cabinet. These considerations have tended to confine acetate in radio applications to small parts, such as knobs, dials and grilles or bezels, most of which are produced by injection moulding, a fact which tends to lower their cost, as the moulding cycle is short. Such parts are employed on wooden cabinets as well as on moulded plastic cabinets, those for wooden cabinets usually being in dark colours matching the wood. Many parts of this character are employed in motorcar radio controls mounted on the instrument panels of cars and matching other plastic trim.



Erie Resistor Corp. and Mack Molding Co. produce these bezels by injection moulding with Tenite. They are used on R.C.A.-Victor radios having wooden cabinets which they match in colour.

A considerable number of quite small cabinets have been produced from cast phenolics which afford unusual beauty in colour and include mottled effects simulating onyx, shell, rose quartz, jade, coral and the like. Such cabinets have to be materially thicker in section than the moulded type and, being made from more expensive material, may cost considerably more, although there is no investment required in moulds. There is, however, some cost for forms such as are required for making the moulds in which the plastic is cast, although this cost is lower than for moulded cabinets. Nevertheless, the natural beauty of the cast plastic has enabled it to compete on a limited scale with moulded plastic cabinets.

Although the styrene plastics have certain properties, such as low electrical losses, which make them useful for certain classes of radio parts, their use in such parts in the United States has been quite limited to date.

Ideas—

By the EDITOR

Number Plates

Ingenuity appears even in such a simple object as number plates for motorcars. Recently we referred to the rubber plate fitted with easily attachable and removable rubber figures. Even though your car is thoroughly smashed up, you will always be able to retain such an unbreakable plate. The latest idea we have seen is the plate made up of separate

cellulose acetate letters and figures. Each is separate and any sequence can be made up very quickly. These loose letters and figures are attached to a blank plate without tools, by simply using a solvent, thus enabling plates to be lettered from stock parts. The colour is permanent and the letters are cheap and can be readily cleaned. Made by Autoplates, London, W.C.2.

Holding The Record.

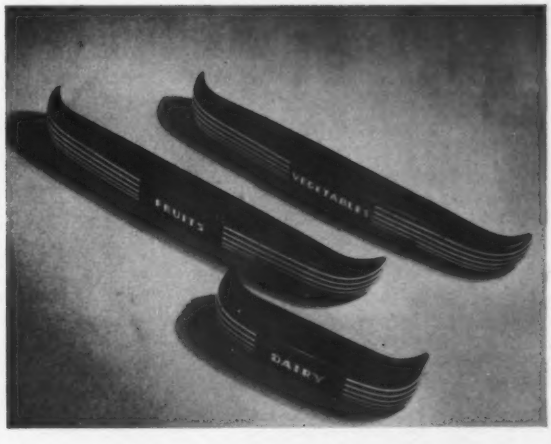
It is always a pleasure to report some entirely new object made in plastics, or a new ingenious way of producing a complicated one—that is, complicated when made by materials other than plastics. The object under review is a holder for gramophone records which is being manufactured by the General Electric Co., of Pittsfield, Massachusetts, U.S.A., for RCA Mfg. Co. Inc., Camden, N.J. As will be seen from the accompanying photograph, the construction of the mould itself must have proved a big problem, since there are 39 curved record spacers $\frac{5}{16}$-in. apart. The design itself is exceptionally clever, employing a minimum of moulding material, yet retaining strength. A special method of controlling warping of the narrow curved spacers was devised by the General Electric Co. The moulding material employed was Textolite.

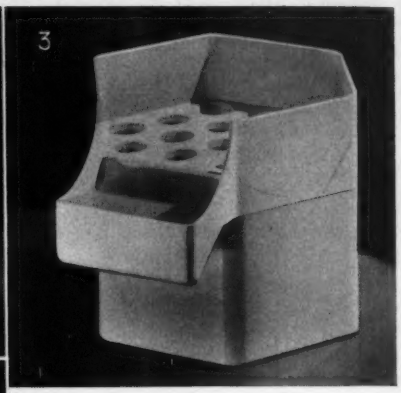
Protecting Glassware

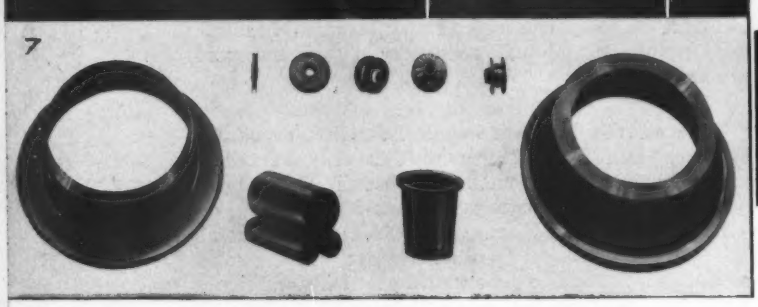
During a recent talk with Mr. P. Mabb, who is an occasional but extremely valuable contributor to this journal, generally on the machining of plastics, conversation turned on rubber latex, and, as a result, he has written an interesting article (to be published in August) on some new outlets applied as a protective film. One of his suggestions is that valuable glass and other easily breakable objects, such as pottery and objets d'art in general, should be sprayed with a film of latex before transport. I do not know if it is Mr. Mabb's original idea, but it is so full of good sense that I pass it on to those collectors and museum officials, to whom, no doubt, transport of such valuable goods is a big problem and sometimes a nightmare. The application of the rubber latex is quite simple, and the film can be made quite thick. This film peels off very easily after it has done its job. The method may conceivably introduce simplicity and bulk reduction in such transport problems.

Drawer Handles.

These beautiful drawer handles, designed especially for the modern kitchen and to satisfy the critical faculties of the modern housewife, have been sent to us by Thermo-Plastics, Inc., of St. Clair, Michigan. The general design is considerably enhanced by the polished black background and white lettering and lines, giving an air of almost hospital-like cleanliness and efficiency. We have here also yet another example of injection moulding utilizing cellulose acetate, a process which is being adopted in America as fast as it is here.







International

IN the new Seth Thomas clocks illustrated, full advantage is taken of the colour possibilities, the appearance and utility of modern moulded plastics. The case for this clock is moulded in one piece of Plaskon by the Auburn Button Works, Inc., of Auburn, New York. Dial is 5½ ins. in diameter with modern, legible black numerals against a white enamelled background. It has distinctive hour and minute hands.

4

BAUSCH AND LOMB, in its new slide viewer for colour films, adds another item to the long list of photographic apparatus and accessories made of moulded plastics. The case of this new slide viewer was moulded in Bakelite by the Auburn Button Works, of Auburn, N.Y., U.S.A., and is available in black, warm brown or soft green to harmonize with any home furnishings.

1

J. AND E. ATKINSON, LTD., the famous manufacturers of high-grade perfumes and toilet preparations, are now making use of plastics for their latest display stand. The one illustrated is moulded in green Scarab and has been so designed that the Beauty Box can rest upon it with the lid open, and it can also be used to display the seven items without the box. The moulding was carried out by the Streetly Manufacturing Co., Ltd., Streetly, Birmingham.

2

APART of the equipment used to make the Jolly Gulp, a new frozen delicacy from the U.S.A., consists of two pieces of moulded Plaskon called the filler top and filler tray. They are used to fill the ingeniously designed cardboard containers in which the Jolly Gulp is sold. This Plaskon filling unit is attractive, sanitary, durable, easy to clean. Plaskon is manufactured by the Plaskon Co., Incorp., U.S.A.

3

MOULDED by the injection process of cellulose acetate, this novel and yet very practical oilcan should prove a useful asset to the family tool chest. It is moulded by Fraser and Glass, Ltd., Woodside Lane, North Finchley, London, N.12

5

DUAL RANGE VOLTMETER, Model 105, manufactured by the Bendix Radio Corp., Detroit, Michigan, U.S.A. The housing and terminal screw and push-button are moulded by the General Electric Company, U.S.A., in various colours. This voltmeter is part of the new automotive accessory equipment recently announced by Bendix.

6

LAMINATED material is now being extensively used for the fabrication of essential parts for the aircraft industry. On the extreme right and left are shown anti-fretting bushes for airscrews, and

7

the other mouldings represent pulleys and cups. All the examples are made by the Bushing Co., Ltd., Hebburn-on-Tyne.

KURZ-KASCH, INC., Dayton, Ohio, U.S.A., are responsible for this ingenious and compact container for drugs. It is made of Lucite, and the receptacles are provided with moulded closures of different sizes so that it is impossible to screw on the wrong cap and so confuse the identity of the vial. Medical men are enthusiastic about this four-in-one container.

8

THIS patent matchbox, the selling rights of which are held in this country by F. J. Davis, Ltd., is moulded by Crystalate, Ltd., Moorgate Hall, 153, Moorgate, London, E.C.2. The device can be widely used for advertising purposes by imprinting on the side of the matchbox by various methods which Crystalate, Ltd., have available.

9

THIS sandwich container, moulded of amino resin powder by Stadium, Ltd., is in good demand by motorists. The clean colour and hygienic and durable plastic surface are factors contributing greatly to the popularity of this picnic accessory.

10

CRYSTALATE, LTD., 153, Moorgate, London, E.C.2, have sent us this advertising novelty moulded in Crystalate material. The pencil stand is supplied complete with four pencils and is a useful addition to the desk.

11

HERE'S a sensible accessory for the bathroom. Moulded of Lumarith, a product of the Celluloid Corp., U.S.A., it is designed to hold a glass and several toothbrushes.

12

ECKERT AND ZIEGLER, of Germany, have sent us this photograph of new injection mouldings produced in Germany on their machines. In design and finish these examples fulfil all practical requirements and show the amazing fidelity of detail now possible by the use of modern injection-moulding machines. It is interesting to note that in place of cellulose acetate use is now being made of the home-produced styrene resins for this type of injection-moulding work.

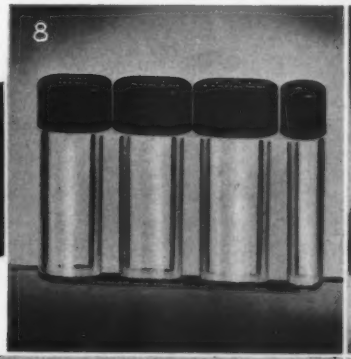
13

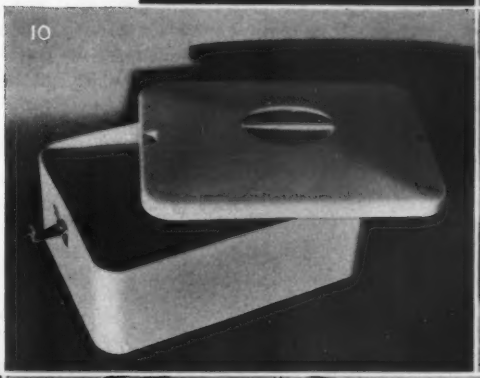
THIS is a very practically designed toothbrush holder, which should find a welcome in a large number of bathrooms. It is moulded of Bexoid by Halex, Ltd., a subsidiary of the British Xylonite Co., Ltd., and sold by most chemists and stores stocking Halex ware.

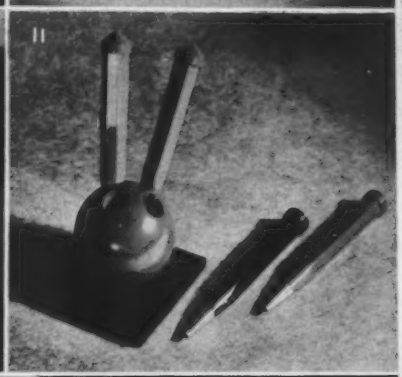
14

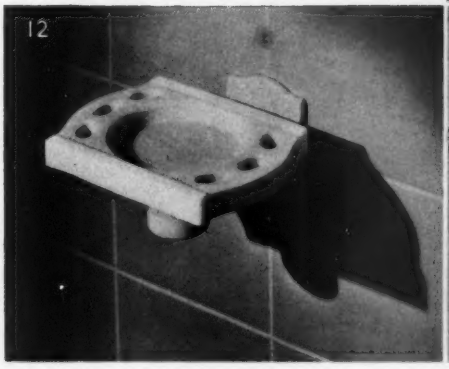
Release

A Selection of New and Interesting Mouldings from England, America and the Continent









NEW MOUNTS—

FOR METALLURGICAL SPECIMENS

By J. HINDE, M.Inst.W.

The writer, a well-known metallurgist, describes some of the new methods employing plastics that have been devised to facilitate the preparation of metallic specimens for microscopic and other examinations

BEFORE proceeding to the main theme of this article, some explanation of metallographic technique is necessary. Metallography is essentially that branch of metallurgy which deals with the microscopic structure of metals and alloys. The metallurgical microscope differs from the more usual type in so far that the specimens are generally examined by reflected light. Before any such examination can be made, suitable preparation of the specimen is necessary.

The specimen to be examined must have one face treated until a mirror finish tolerably free from scratches

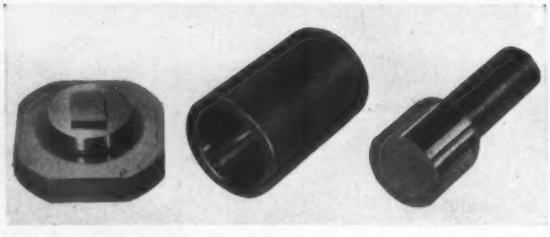


Fig. 1.—Parts of simple mould for making plastic mounts.

is obtained. To do this, the specimen face is first filed or ground flat and then smoothed with emery cloth. From this stage French emery papers are used. Either the specimen is rubbed on the papers, or else held on a revolving disc which carries the paper. Progressively finer grades of emery paper are employed until only very faint scratches remain. These scratches are finally removed by polishing on wet broadcloth, impregnated with jeweller's rouge, chromium sesquioxide, or some other polishing powder. Mop polishing or buffing is not suitable for metallographic specimens.

For convenience, most metallographists would choose a specimen about ½ in. cube. This is easy to manipulate on the polishing papers or machine. More frequently, however, one is unable to choose the dimensions of the specimen. For example, the metallographist may have to examine the edge of a cutting tool, or a section through metal ribbon. No specimen of this type can be held in the ordinary way and be satisfactorily polished. Such specimens must be fixed in a mount of some kind.

Methods of holding specimens are many and varied. A razor blade section could be held between two pieces of steel or brass and the whole "sandwich" polished. Awkwardly shaped specimens may be cast into beeswax or, say, sealing wax. Yet another method is to cast the specimen in some fusible alloy such as Wood's metal. The more modern way, and one popular with an increasing number of metallographists, is to fix the specimen in a plastic mount.

In a laboratory dealing with dozens of specimens a week, the writer has evolved a simple mould for preparing plastic mounts. The essential parts are a base, over which fits a tube, and inside the tube slides a plunger. These parts are illustrated in Fig. 1. The specimen is placed on the base and the tube fitted, then the required amount of plastic powder poured into the tube. The plunger is inserted and lightly tapped. The whole mould is fixed in a vice and heated with a bunsen flame as illustrated in Fig. 2. When the plunger "gives" at gentle pressure from the vice, the vice is then closed as tightly as possible and the mould allowed to cool. The mount is removed by light tapping of the plunger. This

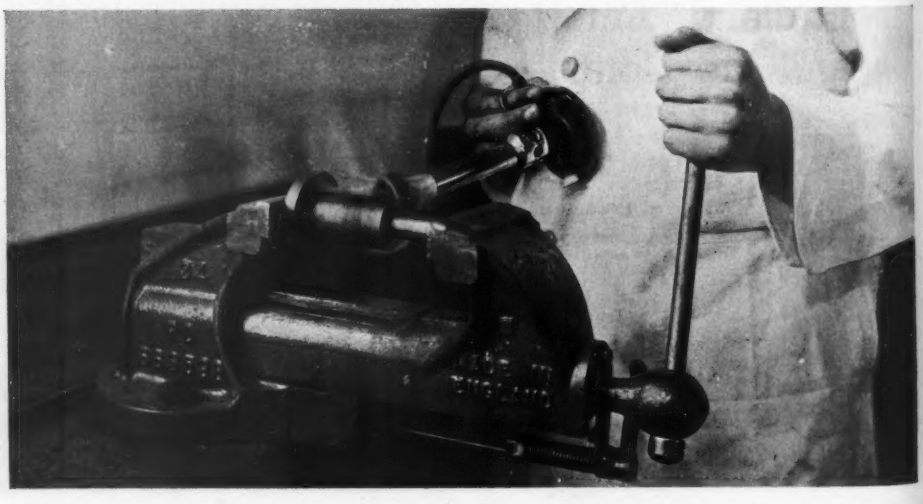


Fig. 2.—The assembled mould is filled with the powder and heated while fixed in a vice.

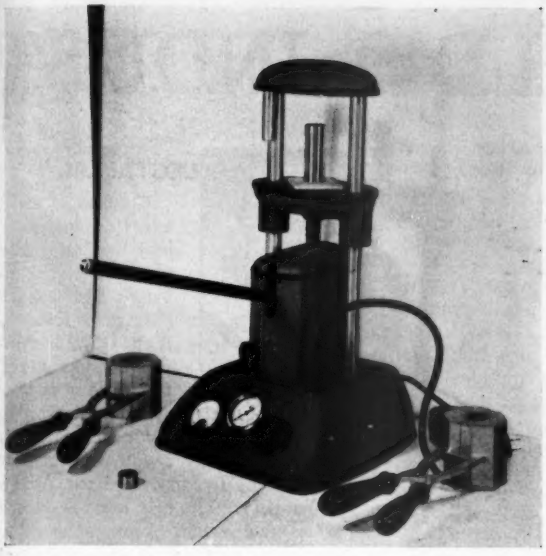


Fig. 3.—The Fisher press for preparing metallurgical mounts.

forces off the base and drives the mount from the tube. This may sound a little crude. Some attention has been paid to more controlled heating and cooling. These "improvements" have, however, been abandoned because they detracted from the simplicity of the instrument and caused trouble.

Special presses for making metallographic mounts are on the market. An excellent one is the Fisher press, which is illustrated in Fig. 3. This press consists of a base on which are mounted two columns which guide a movable platen 5 ins. by 4¾ ins., fitted with insulating plates, raised by the ram of a hand-operated hydraulic press giving a pressure up to 5,000 lb. The cross-head at the top of the press is secured to the steel columns and bored to pass a thermometer which enters the mould. The mould, made in a hardened tool steel, is in three parts—a lower plug, a die and a plunger. An ejector piston attached to the cross-head and a recess in the lower platen to receive the cylindrical mould permit the ejection of the finished mounted specimen. The heating and cooling methods are unique. Split aluminium blocks are used. The heating blocks carry electric heating elements. The cooling blocks are of solid aluminium which quickly dissipate the heat. A voltmeter, pressure gauge, rheostat for the heating elements and socket to connect to the heating block are all neatly fitted into the base. The whole press is 21½ ins. high and weighs some 75 lb. With a press of this kind, bubble-free mounts are produced every time.

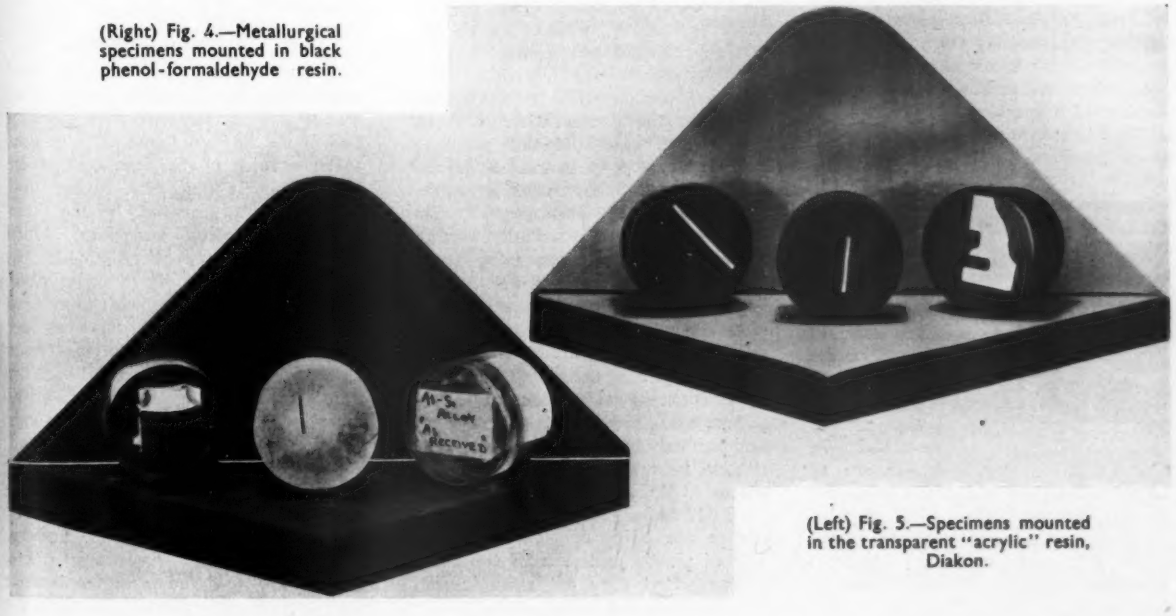
Originally the writer used a black phenolic resin. Some specimens mounted in this are illustrated in Fig. 4. The advent of transparent materials proved a boon to the metallographist. Frequently it is vital to polish down a section to a given position, and to be able to see all the specimen during preparation is an obvious advantage. Identification of specimens in transparent mounts is easy. A strip of card containing the necessary legend can be incorporated in the mount as shown in Fig. 5. The mounts illustrated in Fig. 5 were made from Diakon.

For detailed metallographic examination of metals it is usual for them to be etched with an acid or some other chemical. The mount must, of course, resist the action of any etching reagent used for the specimen. In both Fig. 4 and Fig. 5 the specimen seen in the middle has been severely etched without undue effect upon the mount. There must be no shrinkage of the mount away from the specimen, or else the etching reagent creeps into the space and causes trouble during the subsequent microscopic examination.

For some extremely hard specimens, particularly those hardened on the edge only, the writer has sometimes found plastic mounts to be a little too soft and the edge of the specimen tends to remain proud of the mould. Some improvement has been effected by adding various materials to the plastic, such as the oxides used for polishing. It occurs to the writer, who is a metallographist, that those with an expert knowledge of plastics may be able to suggest a variety of materials suitable for his purpose.

Finally, the writer is indebted to Messrs. Griffin and Tatlock for the photograph of the Fisher press, and to Mr. E. R. Gadd, chief metallurgist of the Bristol Aeroplane Co., for permission to publish this article.

(Right) Fig. 4.—Metallurgical specimens mounted in black phenol-formaldehyde resin.



(Left) Fig. 5.—Specimens mounted in the transparent "acrylic" resin, Diakon.

WORLD'S INDUSTRIAL

TEXTILES

Glass silk and rubber now being used in America with success. Latex is combined with glass silk to give a filament which is moth and mould-proof, resistant to sunlight, heat and all acids, with exception of hydrofluoric. According to *Rubber Age*, May, 1939, one use indicated is for the production of filter cloths which resist high pressures and are not easily abraded; for the filtration of air in connection with air-conditioning plants, polishing cloths, conveyor bands for carrying materials at high temperatures, accumulator diaphragms, etc. **Cellulose fibres** having wool-like characteristics can, according to new English patent, 501,531, be prepared from viscose solutions containing albumen. The process comprises the coagulation of the spinning solution in a neutral precipitating bath so as to give a thread of cellulose xanthate. This coagulated thread is then decomposed in an acid-free bath to form cellulose hydrate. In an example viscose is produced from alkali cellulose and 7.5 litres of it containing 7.5 per cent. cellulose and 6.5 per cent. alkali are mixed at reduced temperature with a solution of 300 grammes of fresh casein. Immediate spinning of this solution is then effected through 0.08-mm. diameter nozzles in gold-platinum, into a bath of 80 per cent. methanol and 20 per cent. water. The thread draft is 40 metres per minute, and it is immersed to form 4 to 35 cm. in the bath. The thread is pressed, cut and then decomposed in a hot neutral bath of sodium sulphate; further treatment of the normal kind is followed by the drying of the fibre, which is found to be circular in cross section in a manner similar to wool. Its feel is soft and it curls well.

GENERAL ENGINEERING

Shot-gun fore-ends have been impregnated with synthetic resin in order to make them harder and more suitable for use. The process is described in B.P.500,223. The fore-ends are of black walnut wood and are immersed in an autoclave filled with unpolymerized methyl methacrylate mixed with 0.5 per cent. of benzoyl peroxide catalyst. Nitrogen is used to maintain a pressure of 200 lb. per sq. in. and when the wood fore-ends are removed they are heated for 12 hours at 80 degrees C. to harden the resin. They are stated to contain 27 per cent. resin after treatment. **Industrial machinery guards** on high-speed lathes, grinding machines, printing and many other types of machinery, also inspection panels in sand-blasting equipment and in flour milling and similar machinery now made of transparent, polished cellulose acetate sheeting material, thickness 1 mm. to 6 mm. The advantages claimed are that acetate possesses excellent clarity, is non-inflammable, non-discolourable, easily moulded to special shape and is, of course, unbreakable. **Synthetic rubber** is now widely used for engineering applications. Ioco Rubber and Waterproofing Company, Ltd., have produced their "Neolin" range, which has neoprene as its basic material, for roller coverings for oil, cuprammonium proofing, oil hose, high-pressure steam hose, resisting pads, mouldings, gaskets, washers, proofed fabrics, balloon fabrics. Tensile properties of "Neolin" at least equal to rubber, while the outstanding property of these qualities is the remarkable manner in which this new range of products withstands the prolonged action of oil, fats, solvents, etc., without undue swelling and deterioration, such as occurs with rubber compounds. **Sealing floating roofs** now in common use in industry and the Wiggins' Floating Roof is particularly well known in the U.S.A. It floats on the surface of stored liquids—and minimizes evaporation of them and the opportunity for dangerous gas vapours to accumulate above the surface of the liquids. It is generally considered to be ideal equipment for the conservation of crude and refined oils. Thiokol synthetic rubber is used to form the flexible part of the seal that makes a vapour-tight contact with the tank shell. The flexible seal must constantly provide perfect protection from rain, snow, temperature changes and fire hazards for the oil stored within. Thiokol's oil-resistance and durability survived exhaustive tests to which many materials were submitted for this application. **Packing** for joints and pumps made from sheets of spun glass and united by means of synthetic rubber is manufactured by United States Rubber Products, Inc. (B.P.502,643). **Benzine delivery pumps** are being constructed internally of plastic materials in Germany. Claimed that they are safer in use.

ELECTRICAL

German electrical industry now making extensive use of substitutes, says *Electrical Review*, May 12. Aluminium has taken the place of copper for the conductors, cotton wrapping has been replaced by cellulose wool, silk insulation by rayon, and rubber is now being replaced by buna (artificial rubber). The first buna-insulated cables have recently been exported to Manchukuo, and it is expected that by the middle of the year all, or nearly all, wire and cable exported will have buna insulation in the place of rubber. The use of artificial plastics, notably for insulation, has developed very considerably, and the German electrical industry is now using an ever increasing quantity of these materials. It is estimated that about one-fifth of the plants for the production of plastics are in the hands of electrical manufacturers. **Alloprene** has interesting electrical properties. Power factor 0.003, dielectric constant 3.0 to 3.4, dielectric strength 2,500 volts per mil. These figures obtained at the Teddington research laboratories. **Fluorescent Bakelite** now being used for moulding electrical equipment for use in power station control-rooms, switchboards, etc. It is claimed that fluorescent switch covers, labels, indicator signs, etc., are particularly valuable in case of air raids. **Synthetic rubbers** of the chloroprene type (e.g., neoprene Neolin, Nordoil), etc., have greater resistance to hot oil than ordinary rubber, and investigations are in hand with a view to using such materials as a substitute for standard cork gaskets. Developments have taken place in synthetic varnish cloths, insulated bolts, hard rubber compounds, rubber and cork gaskets, treated woods and various insulating varnishes, while experiments have been made to discover the possibility of using glass insulating in the form of tape and glass-covered wire. Research work has been done on such insulating materials as seekay waxes, improved cotton yarns, tapes and cloths, pressboards, ceramics, asbestos-cement insulating boards and various moulded and laminated compounds. Glyptal finishing paints for use on insulating parts have also been investigated, as a result of which this material is finding increasing uses for protecting parts subjected to acid fumes and moisture.

TREMPLOYS PLASTICS

AIRCRAFT

Doped fabrics for aircraft discussed in Technical News Bulletin of The National Bureau of Standards, March, 1939. Despite extensive use of metal construction in fabrication of modern commercial and military aircraft, doped fabric continues to meet need for a light and relatively inexpensive covering for low-stressed members and for the wings and fuselage of small aeroplanes. The "dope" which is applied to the fabric to make it impermeable to air and to weatherproof it, consists of a film-forming material dissolved in organic solvents. Cellulose nitrate is at present commonly used as the film-forming base, but it is easily ignited and the rate of burning is very rapid. The Bureau of Aeronautics of the Navy Department, therefore, requested the Bureau to develop a non-inflammable dope which would compare favourably with or surpass cellulose nitrate dope with respect to the effects of normal ageing and high relative humidity on the tautness of the doped fabric. Plastics examined were cellulose acetate, cellulose triacetate, hydroxypropylcellulose, triacetate, cellulose acetopropionate, cellulose nitrate, acetobutyrate, chlorinated rubber, methyl methacrylate resin and isobutyl methacrylate resin. The full decisive results of experiments are not yet to hand, but when concluded they will be published. **Cellulose acetate** for use in aeroplane construction has good machining characteristics and can be turned, milled, routed, sawed, drilled, etc., like wood or soft metal. It can be bent to shape after heat softening and stamped or formed into three dimensional curves by swaging under heat and pressure. Because of its extreme toughness it can be readily nailed, riveted or bolted so that joining offers no difficulties. Cementing is readily accomplished with special cements. In joining two sheets of lumarith, either solvents or bodied cements may be used, and the action is entirely on the surface. Solvents such as acetone, methyl acetate, etc., can be used as well as those which have no injurious effects on the metals used in aircraft construction. Local repairs are possible in the field either by bolts, rivets, etc., or by cementing. Longevity is indefinite in indoor use and almost indefinite in outdoor use, since neither corrosion nor the atmosphere affects the material. Disregarding the innumerable uses of moulded cellulose acetate parts in general industry, their uses at the present stage of development and strength properties in the automobile industry offer the closest analogy to the aeroplane. For the past three years some of the leading motorcars have been equipped with moulded cellulose acetate hardware, and it has been predicted that practically all the 1939 models will use cellulose acetate in such parts as dome lights, door handles, electrical equipment, escutcheons, gear-shift ball, gasoline cap, hardware, horn button, instrument panel, lighter knob, mouldings, steering wheel. In the light of the car analogy, and of the information previously presented, aeroplane designers and constructors may see possibilities of utilization in the following non-stressed items:—Window frames or moulding; doors, hatchways, stairs, etc.; interior finishings; flooring; door handles, chairs, tables, cabinets; fillets, fairings, etc.; instrument cases, instrument panel, containers, etc.; air ducts; acoustical and thermal insulation applications; pulleys; instrument brackets, shelving, etc.; electrical equipment; miscellaneous small parts. There is no doubt that further study will reveal other items where cellulose acetate may be substituted. Even though more extended utilization in structural parts is disregarded for the moment, cellulose acetate products may have a definite part in improving the general finish and appearance of aeroplane construction, in simplifying maintenance, and in decreasing producton costs. It is also interesting to speculate on what could be done with the extremely thin gauges available in wing or fuselage covering. In seeking high structural strength, the method pursued hitherto has been to impregnate fibrous material with a phenolic resin, with subsequent moulding under heat and pressure, the thermo-hardening process resulting in products of considerable strength. A synthetic resin base, a truly plastic material, has a tensile strength of 5,000 to 6,000 lb. sq. in. and in compression tests will suddenly shatter. If fabric or cord reinforcing materials are used, the strength becomes much higher, but varies with the direction. Dr. Gough, in his recent Wilbur Wright Memorial lecture, gives particulars of some interesting reinforced plastic materials: (1) Resin reinforced with flax cord in the direction of the chords: tensile strength, 69,400 lb /in.^{2}; compression strength, 30,200 lb./in.^{2}; shear strength, 2,000 lb./in.^{2}; Young's Modulus 7.4 by 10^6 lb./in.^{2}; specific gravity, 1.45. (2) Cellulose fluff impregnated with phenolic resin, with the raw material in the form of thin cardboard-like sheets, moulded into the required form under a pressure of 2 tons/in.^{2} at 150 degrees C.: tensile strength, 22,000 lb./in.^{2}; compression strength, 22,500 lb./in.^{2}; shear strength, 7,000 lb./in.^{2}; Young's Modulus, 2.1 by 10^6 lb./in.^{2}; proof stress, 12,500 lb./in.^{2}; specific gravity, 1.39. Undesirability of the first material lies in its low shear stress, which implies weakness in torsion of the aeroplane structure. The second material is much better balanced and it is the one which has been recently employed in an experimental wing built in England. In overall weight and strength this wing compared favourably with its wooden prototype.

MOTORS

Transparent car shown at New York World Fair on the stand of General Motors. The fenders, hood and body panels are made of Lucite, the methyl methacrylate resin manufactured by Du Pont De Nemours, Incorp. **Girling** brakes with hydraulic operation now make use of neoprene tubing. This enables ordinary mineral oil to be employed, having a flash of 330 to 340 degrees F. and a pour point of minus 60 degrees F. Such a fluid would attack and destroy normal rubber and hence all the piping is made of neoprene. Neoprene also used for rubber cups which are employed in the wheel cylinders. These abut directly on the normal Girling expander, which is, however, pushed towards the rollers instead of being drawn through them as in the mechanical system. **Lagonda, Le Mans model,** makes novel use of phenol-formaldehyde resin, which is used as a distance piece between the base of the oil pan and the sump, having the studs running through it, the idea being to deepen the sump and to project the base of the oil pan farther into the wind stream underneath the car. The engine of the new car is substantially standard, but has revised carburation, higher compression and the deepened sump gives better cooling and greater oil capacity. Two of these cars were entered for the famous race and put up a very creditable performance.

CHEMICAL

Buna rubber in the chemical industry discussed in article *Chem. Fabr.*, 1938, 11, 281-283. Perbunan combines good elastic properties, abrasion-resistance and relatively good electrical conductivity with high resistance to swelling in oils (percentage increase in weight in heavy petrol in eight weeks: Perbunan 43, natural rubber 226; in paraffin oil, 3, 140). Buna-S combines resistance to heat, pressure and abrasion with high insulating value. **Protecting pipelines** with new synthetic rubber-like compound made from vinyl halide resins is now being undertaken in American chemical industry and it is recommended as an adequate protection against soil corrosion, also useful for the outside of pickling tanks against atmospheric influences, for gas-masks, and for the inside of tanks containing corrosive chemical solutions. It may be applied by painting or spraying and has in many cases been found to be superior to other rubber compounds. In particular it promises to find a growing outlet in containers used in electro-plating where metals are coming into contact with chromic acid or mixtures of nitric and hydrofluoric acids. Another of these compounds also counts resistance against acids (concentrated sulphuric and muriatic acids are mentioned in particular) amongst its special merits. It is a thermoplastic material with a depolymerized colloid resin base and combines a high flexibility with attractive chemical properties. It may be used in acid stripping tanks, in paper mill chlorinator towers, in electrolytic tanks for refining copper, zinc and lead, in acid-proof floors, and in coke boxes. These few examples show how wide an outlet is available for such materials and also what special efforts are necessary in order to discover all potential customers. A difficulty which seems not yet to have been overcome is their behaviour at high temperatures (*Manchester Guardian Commercial*, 16/6/39). **Packing rings** made of plastics for gas-washing towers have been suggested as improvement over the usual ceramic type from the point of view of lightness and ease of manufacture. Such rings would be about half the weight, saving tower construction costs, and could be extruded in a form of comparatively complicated structure to afford better distribution of the washing liquor and expose a greater surface to absorption. Synthetic resins, unattacked by alkalis or acids or oils, are selected for specific absorptions. **Diffraction gratings** are moulded by hot-pressing plastic material of a basis of a polymerized acrylic acid ester in or upon a mould or under a die upon which the pattern of the grating is ruled. The plastic material may be a methyl-methacrylic acid ester, such as that known under the registered trade mark "Perspex." The die may be of steel. A sheet of the plastic material may be placed on the die and pressure applied by a weight on a glass plate resting on the material. The temperature is maintained at 100 degrees C. for half an hour. The grating may be moulded integral with a mounting and may be on a plane, concave or convex surface. (B.P.501,606, A. Hilger, Ltd.)

MISCELLANEOUS

Wood pitch for the manufacture of plastics is suggested in an American patent. The residues from the purification of rosin—a substance which cannot be dissolved in mineral oils—is treated with aldehydes (e.g., 5 per cent. of paraformaldehyde) until an insoluble and unfusible condensation product is obtained. This can be pressed in the usual way after addition of hexamethylene-tetramine and a filling material. From Sweden another method for the treatment of cellulose fibres for the manufacture of plastics is reported. Cellulose fibres are mixed with alum and resin and pressed in the form of thin foils. These are loosened by mechanical means, until a mass resembling wool is obtained. This substance is mixed in the ratio of 9 to 1 with the original mixture and a plastic can now be formed under heat and pressure. Abstracted from *Manchester Guardian Commercial*, June 2, 1939. **Impregnating cellulose foils** suggested in recent American patent. One of the new methods consists of 10 parts of resin, five parts of paraffin-wax, one part of triphenyl-phosphate, and 100 parts of toluol. Another contains 15 parts of a polymerization product (for instance, 60 per cent. vinyl chloride and 40 per cent. vinyl acetate), seven parts of tricresyl-phosphate, three parts of paraffin-wax, and 100 to 200 parts of toluol. Still another of these impregnating solutions consists of an emulsion of water-resistant substances (like casein with an addition of paraffin-wax) and viscose; a water-resistant resin is used for applying the solution and making the foils. **Pliolite covering for paper,** discussed in *Paper Trade Journal*, 108, 1939, and it seems likely from information given that this covering may soon be a commercial proposition. **Explosive dusts** in factories manufacturing gramophone records and galalith articles, are described in *Prom. Org. Chim.*, 1939, 6, 104-106. Explosions may take place with the following concentrations of dust: shellac 15, asphalt 15, colophony 5, gramophone-record composition 10, mixtures of these dusts with soot, graphite, and bone charcoal 10-25, galalith 8 g. per cubic m. of air. **Vinyl resins for gramophone records** now advocated by writers in *Prom. Org. Chim.*, 1939, 6, 164-167. The composition stated to be polychlorovinyl resin 21, Novolac resin 21, slate 49, soot 45, pitch 5.5, calcium stearate 2, and wax 2 parts. **Artificial dentures** described in new patent, B.P.498,877, taken out by Amalgamated Dental Co., Ltd., and S. W. Wilding. A mixture is made of 20-40 per cent. styrene and 80-60 per cent. of powdered polymerized methyl methacrylate, colouring matter, etc. **Porous cellulose triacetate foils** mentioned in recent patent, B.P.502,046. Produced by incorporating in the cellulose triacetate a soluble substance which is afterwards dissolved out of a substance, such as ammonium nitrate, or ammonium carbonate which is vaporized. **Microporous films,** skins or coatings are made by coating or spreading a support with a dispersion of rubber or other film-forming substance in the state of a smooth, cream-like foam, applying a powdered substance to the foam and causing the foam to collapse to the desired thickness and subsequently to set, the powdered substance being thus caused to enter into the foam structure so as to maintain the reticular nature of the structure. The powdered substance may be finely divided fibres, e.g., wool, rayon, cotton, jute or hemp, talc, calcium sulphate, or mixtures of these. Process described in B.P.502,733. **Cellophane masks** now being used by surgeons in operating theatres. Professor Hugh Cairns, who has made a special study of asepsis in the operating theatre, recommends their use, although he admits that with them it is rather difficult to prevent dimming of spectacles. This disadvantage may, however, be overcome later. **New packaging material** suggested by recent work carried out at the Mellon Institute of Industrial Research, U.S.A., for the Texas Gulf Sulphur Company. Tough, pliable packing materials have been produced by lamination of paper products with plasticized sulphur. **Plasticase** is the trade name of a new kind of optical frame carrying case, moulded of Du Pont Plastacele cellulose acetate moulding powder and manufactured by the Zylocase Company, of Irvington, New Jersey. Light in weight, yet strong, the case comes in vari-coloured mottled translucent effects and may have the name of optician printed on the sliding top.

Resin Impregnated Wood for Pre-fabricated Houses

Here is an account of a bold American experiment in the use of synthetic resin impregnated plywood for the construction of a five-room luxury house priced at just under $3,500. *If this venture proves successful we envisage a great future for pre-fabricated houses made of this new weather resistant, rot proof and insulating building material*

IT has been said time and time again that what the building industry needs is a Henry Ford, in order that modest, inexpensive homes, well built and popularized, should be within the means of millions of families of limited incomes. Now comes news from America that a pre-fabricated house, made of resin-impregnated plywood, has recently been constructed and, whilst fulfilling all the requirements for a sturdily built, properly insulated, labour-saving design, is low priced and well within the reach of the American working class.

The home, designed by John Yeon and built by Burt Smith, is situated at Lake Oswego, an exclusive Portland, Oregon suburb, and is a spacious five-room residence costing just under $3,500, or a little over £700 in sterling. The accommodation comprises a spacious 13-ft. 6-in. by 19-ft. 6-in. living-room, 10-ft. 6-in. by 14-ft. 6-in. and 11-ft. by 11-ft. bedrooms, modern bathroom, 10-ft. by 10-ft. kitchen, 8-ft. by 9-ft. service-room and single garage.

The exterior is Resnprest weatherproof plywood, which is plywood impregnated with Durez phenolic resin manufactured by General Plastics Incorp., 93, Walck Road, North Tonawanda, N.Y., U.S.A. This material was chosen because of its beauty and adaptability to smooth wall construction, its permanence, strength, rigidity, greater insulation value, and because of its increased resistance to wood-boring insects, termites and dry-rot fungi.

The house has many unique and revolutionary features, and the windows deserve special mention. Every one is sealed so tightly that each is positively air and moisture-tight. Ventilation is provided by ventilation louvres placed beneath all windows. These louvres, designed and perfected by Yeon and Smith, have been under trial in Portland residences for over two years and owners report them outstandingly satisfactory. On the exterior they appear as batteries of stationary slats. Behind the slats is screening, and that's all there is to be seen outside. Inside, beneath every window, is a modernly designed hinged door set in weatherstripping. When opened, the doors allow free passage of air into the home. This newly completed house is so tightly constructed that when all exterior doors and ventilating louvre doors are closed the fireplace will not draw, and only when a louvre is opened will the fire begin to crackle. Yeon and Smith point out many advantages of their ventilating system. All windows are burglar-proof. A home may be ventilated constantly, rain or shine, as no moisture can blow in through the louvres. Curtains may be drawn without interfering with the ventilation of a room. Light and

vision are never grayed by screens. Only the louvre openings are screened.

The house is equipped with Bendix washer, Mueller gas furnace and air conditioning ducts from every room. A unique service is the drying-room adjacent to the furnace-room.

Every care has been taken to insulate the house adequately. Exterior walls are of Resnprest over 1-in. tongue and groove with 15-lb. Johns-Manville felt between. Roof is of 2-in. tongue and groove shingled with cedar shingles. All ceilings are insulated with 1-in. thick Thermax insulating material. Records kept during the past 30 days show that the house is extremely economical to heat. Burt Smith, the contractor, reports that:—

"Because of the extremely rigid construction of this house over a 4-in. thick concrete slab, the possibility of cracks ever appearing in it are practically nil," Smith explains. "Furthermore, such construction insures perfect non-sticking doors at all time." All interior doors are M. and M. Flush Hollow-Core panels, sturdily made, practically warp-proof. All cupboard doors are of M. and M. patented Cupboard Door Stock. In line with modern interiors, casings at doors and windows are eliminated, the plaster being applied flush to all window and door jambs over metal casings.

Entire exterior is finished with three coats of exterior lead and oil paint, finished in a soft green stippled effect. All interior plaster is treated with two finishing coats and is washable. All trim, kitchen and bathroom are finished with three coats of paint, the final a semi-gloss. Interiors vary from off-white to cream, a colour scheme which achieves a feeling of spaciousness throughout the house.

Most unusual single feature of this house is the window treatment. Plate glass is inserted between the studs, and ventilation is provided by louvres beneath the windows. Advantages claimed by the builder are the elimination of screens from view, greater security against burglars, reduction of heat loss, free ventilation in all kinds of weather Other structural innovations are listed in the construction outline The plan is excellent—a de luxe version of the minimum house. Most pleasing characteristic of the attractive exterior is the simple expression of the carefully integrated construction made possible by the large Resnprest plywood panels. Lot size: 72 ins. x 126 ins. Cubage 7,800 ins.

CONSTRUCTION OUTLINE

Foundation: Walls—concrete and native stone.

Structure: Exterior walls—2-in. by 4-in. fir studs, 16-in. o.c., dry 1-in. by 6-in. T. and G. fir, 15-lb. saturated felt, RESNPREST plywood M. and M. Wood Working Co., Portland, Oregon fir battens, 28-in. o.c. Interior partitions—2-in. by 4-in. fir studs, 16-in. o.c., plaster on metal lath. Floor construction—4-in. concrete slab.

The severe design and clean, smooth-faced appearance of this bungalow are due in no small measure to the use of the new Resnprest plywood for its construction. It is a unique material in many ways and shows up to its best advantage when properly painted.

A glimpse at the attractive and practical kitchen (Burt Smith house, Oswego) shows lots of cupboard space behind smooth, flush M. and M. cupboard doors. Note the spacious windows and revolutionary new ventilating louvres. This is the type of house, or rather bungalow, which should meet the requirements of British as well as American house-hunters.

Roof: Construction—2-in. T. and G. fir laid vertical, rafters omitted, Purlin plates supporting, covered with 5/2 Perfect V.G. shingles laid 4 ins. to weather.

Chimney: Clay brick with clay tile flue lining. Damper—cast-iron. Firebox lined with split brick.

Sheet Metal Work: Flashing—28 gauge galvanized iron. Ducts—40-lb. tin.

Insulation: Attic floor—1-in. Weatherstripping—Interlocking metal.

Windows: Fixed windows set in structural members, no sash used. Glass—crystal plate, $\frac{3}{16}$-in. Screens—built-up, galvanized iron frames fitted to ventilators, removable.

Floor Coverings: Main rooms—oak blocks set in asphalt. Kitchen and bathrooms—linoleum laid over Quarterboard. Porches—concrete.

Wall Coverings: All rooms plaster on Steeltex lath.

Woodwork: Thrim—$\frac{3}{4}$-in. metal casing, painted fir base set before plaster. Cabinets—plywood, M and M Cupboard doors. Interior and exterior doors—Flush Hollow-core, M and M Wood Working Company, Portland, Oregon. Garage doors—$\frac{1}{4}$-in. RESNPREST plywood on 2-in. frame, overhead type.

Painting: Interior: Walls and ceilings—Hidewall wall paint. Kitchen and bath—super white. Floor—Pentrafill. Sash—Semi-gloss Vevetex. Exterior: Walls—exterior paint. Roof—Super Fine shingle stain.

Electrical Installation: Wiring system and switches—General Electric Company.

Laundry Equipment: Equipped with Bendix washer at owner's option.

Heating: Automatic gas furnace with Climatrol air conditioning unit. Combination furnace stat and high limit control. Da-Nite Acrathrem control.

Special Equipment: Venetian blinds in living-room, bedrooms and kitchen.

COST BREAKDOWN

Construction.	Materials.	Labour.
	$	$
Foundation	71.00	82.00
First floor	169.00	118.00
Exterior walls	117.00	63.00
Partition walls	28.00	32.00
Roof	231.00	90.00
Interior finish	200.00	152.00
Millwork and trim ...	250.00	292.00
Kitchen and bathroom cabinets and accessories	115.00	60.00
Painting		
Exterior	100.00	40.00
Interior	100.00	60.00
Plumbing		
Piping	80.00	40.00
Fixtures	120.00	10.00
Fireplace	80.00	50.00
Heating (gas automatic)	262.00	120.00
Sheet metal work ...	25.00	15.00
Electrical work	64.00	44.00
	$2,012.00	$1,268.00

	$
Total construction ...	3,280.00
Equipment	520.00
Land and improvements ...	700.00
Profit and overhead ...	250.00
Total cost house and land	$4,750.00

The Bow-Wow Buffet

We have received the accompanying photograph from the Bakelite Corporation of America. The colourful Bakelite moulded "Bow-Wow Buffet" is the latest thing to delight the hearts of canine epicures. It is a scientifically designed, sanitary, combined food and drink bowl. There are no crevices nor square corners to harbour bacteria. Each compartment holds one quart, the combined liquid capacity of both compartments being over two quarts. The "Bow-Wow Buffet"—a product of the Stafford Siekert Co., of Milwaukee—is produced in the following Bakelite moulded colours: sparkling burgundy, sea green and royal ebony. An unusual feature of the buffet, which weighs only 29 oz., is a base with a pure gummed serrated tubing that holds it firmly to all types of floor surfaces, including waxed linoleum, and prevents the bowl from slipping.

In the immediate foreground can be seen the Bakelite moulded "Bow-Wow Buffet."

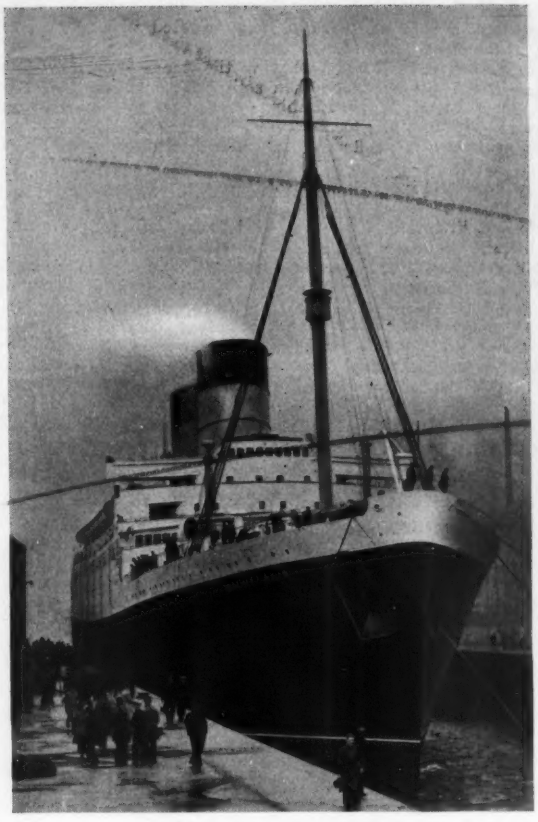
New Novelties from U.S.A.

These amusing and colourful lapel pins and brooches are moulded by the injection process of Lumarith cellulose acetate, supplied by the Celluloid Corporation of America. The actual manufacturers of these novelties are George I. Berkander Inc., Providence, R.I., U.S.A., and we understand that there is a growing demand for them in the principal stores. In this country manufacturers do not appear to have exploited the cheap jewellery and novelty market in the same thorough fashion as they have in the United States, although it would appear there is ample scope, especially as the bright, permanent colours of plastics make such a universal appeal.

Apart from the use of cellulose acetate in modern automatic injection moulding machines, styrene plastics may be used and in Germany a large number of the Ersatz dress ornaments are made of these resins.

Some of these dress ornaments contain cunningly hidden receptacles for miniature photographs.

S.S. "Mauretania" is Furnished with Plastics



ON Saturday, June 17, what appeared to be a billion people saw the new 34,000-ton "Mauretania" leave Liverpool on its maiden voyage to New York. May good luck attend its life!

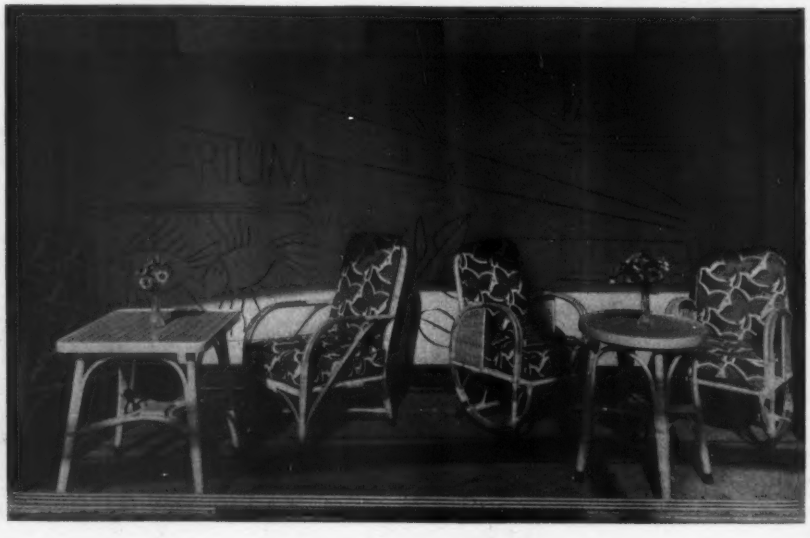
She is described as the most up-to-date ship of its class in the world and very worthy of the famous "Mauretania" it replaces. The fine traditions of the line will be maintained. It is also described as the largest liner ever built in an English port. (We need not mention, perhaps, that the "Queen Mary," of over 81,000 tons, was built in a Scottish port.)

She is unique in yet another important aspect. She is the first British liner in which plastics have been employed in quantity and in a manner which shows that plastics have been considered seriously for interior ship decoration as a constructional material for utility as well as beauty.

The interior treatment of the S.S. "Mauretania" is a delight to the eye, for lavish use has been made of modern decorative materials wherever they offer practical or æsthetic advantages. Bakelite veneers have been extensively employed for the surfacing of table tops, dressing tables, sideboards, etc., while this material is also adopted in some instances for partitioning. In addition to the attractive colours and effects which are obtainable in this decorative sheet, the material has qualities of heat and moisture resistance, light weight and resistance to corrosion which are of particular value in passenger vessels.

In many of the public rooms, including the grand hall, cabin lounge, third-class lounge and smokeroom, all the tables and coffee stools are surfaced with the veneers, the predominating colours being buff and a very pleasing shade of brown. The new fabric-faced material, perfected by Bakelite, Ltd., only a few months back, has been used on tables and counter tops in the veranda café. All the appearance of a gaily coloured cloth is obtained on the tables and counters here without any of the normal disadvantages. The material is real fabric incorporated by the process of manufacture as an integral part of the sheet. Other furnishings surfaced with these veneers include the tops and shelves of dumb waiters and dressing tables, while portions of the third-class dining saloon, corridors, etc., are similarly treated. Many of the tables throughout the vessel are covered with a special blisterproof grade of material which will withstand without blemish direct contact with burning cigarettes.

Full advantage has been taken of the properties of Bakelite veneers in the construction of the cubicles adjoining the tourist swimming baths, the partitions in these being surfaced with the veneer in a delicate shade of green. The treatment-room attached to the baths is panelled with the same material, which, for this particular application, of course, offers the advantages of being exceptionally hygienic and easy to keep clean.



The new Bakelite decorative sheet incorporating a fabric facing is employed in the treatment of table tops in the sun lounge on the "Mauretania."

(Left) Bakelite veneer used for surfacing walls of swimming - bath cubicles.

(Right) Walls of swimming-bath changing - rooms, with surfaces of Bakelite veneer.

(Centre) Corner of Grand Hall on the "Mauretania," showing Bakelite-topped tables.

Below is illustrated a dumb waiter and an occasional table, with surfaces of Bakelite veneer.

Below shows a bar with counters, table tops and occasional tables surfaced with Bakelite veneers.

PLASTICS "YES" AND "NO"

ONE of the best-known manufacturers in the American plastic industry, General Plastics Incorporated, recently sent a questionnaire to several hundred manufacturers in the United States, and, where possible, to the engineering staff of those manufacturers, soliciting answers to a series of questions about the uses and potentialities of plastics in their own particular industries. "Have you ever considered the use of plastics?" was the first question propounded, and 85.4 per cent. of those answering said "Yes," and only 14.6 per cent. said "No."

Chief Objections.

To that 85-plus per cent. was directed another question in the survey. "If you considered using plastics but dropped the idea, what were the chief objections?" Here the really enlightening part of the story began. The objections ranged from "High cost of moulds" by 32 per cent. to "Low yield point" by about one-tenth of 1 per cent. Actually, there seemed to be but six major objections, which were these:—First, mould cost; second, high cost; third, high cost for small production; fourth, brittleness; fifth, lack of strength; sixth, lack of heat resistance.

Obviously, some of these objections rather overlap, particularly the first three and the next two. An answer to one would seem to involve two and three. It is regrettable but factual that the introduction of moulded plastics to industry many years ago was made in the guise of "Substitute." Psychologically this has had some effect on consideration of cost. One cannot be easily reconciled to what one considers a substitute being used which costs more. However, to-day plastics are really becoming accepted as individual structural materials, just as steel, aluminium, wood and glass. When the engineer places them on an equal basis he finds other reasons than original mould cost affecting his decision. The physical properties of the various materials as well as their designability have a real bearing on his recommendation. Custom moulders of plastics almost habitually quote mould cost as a separate item, while metal stamping or casting manufacturers quote per piece with mould or die cost included. Finishing costs must be considered in many applications where plastics might not be used because of mould costs. The elimination of many cleaning, japanning, baking, polishing operations have often proved the ultimate cost of plastics to be lower than other materials even though original mould cost has been labelled as high.

New Methods Cut Costs.

There is no reason to deny that a plastic part may cost more on a small run than a metal one, for example. If the part must be non-corrosive, have a high dielectric strength, be a non-conductor of heat for manual handling, for instance, then perhaps the extra cost might be offset by these advantages. Or, if only a phenolic moulding plastic were being considered, there is a possibility that some other type of plastic might be adapted to the piece with lower unit costs. New methods, processes and presses for moulding are constantly being developed so that the near future will undoubtedly see these cost objections become minor ones and no longer stand at the top of the list.

Specific Savings.

Not long ago a manufacturer of a household item was about to give up the idea of using plastics because it appeared that the parts would cost more than metal ones he had been using for years. But among the questions raised was what advantage the reduced weight of plastic parts would have. The answer proved to be a saving of 1½ lb. per unit. With the shipping weight prepaid, here was an item that actually made possible a small but worth-while saving in transport charges per unit. Plastics were adopted. Another case is that of a fuse box manufacturer who had been using a porcelain housing. Again, weight saving alone made a tremendous difference. The porcelain boxes averaged 17 lb. each, packed for shipment. The phenol-formaldehyde (in this case Durez) moulded boxes average 10 lb. each, packed for shipment. Another manufacturer found that a moulded housing in place of a metal one cost several cents per piece extra. However, the plastic gave him reduced motor noise and saved several pounds per unit in weight. Further, at the end of a year he discovered he had saved many thousand dollars in refinishing costs on his demonstrating units. All these possibilities should be given full consideration before giving up plastics because mould cost appears high, or piece cost appears to be up.

Objections four and five—brittleness and lack of strength—are difficult to separate for individual discussion. Primarily, it seems to be a matter of choice of descriptive words. Many would consider hardness as strength, but though hard the piece might be very brittle and break easily. Consequently, let us assume the two are identical for the purpose of this discussion.

Strength.

When listing the physical properties of plastic materials these four are always shown: impact strength, flexural strength, tensile strength and compressive strength. The impact strength of phenolic plastics ranges from 0.13 to 0.7, with some types of plastics running as high as 3 to 12. Flexural or transverse strength of plastics runs up to 12,000 lb. per sq. in. Zinc is 10,000, but cast aluminium ranges from 15,000 upwards. Tensile strength of phenolic plastics ranges from 4,000 to 7,000 lb. per sq. in., as against 13,000 and up for zinc and 75,000 to 100,000 for stamped steel, while glass is but 3,000. Compressive strength of plastics is about 28,000, although some are said to range as high as 36,000.

Unfair Tests.

At one time an adding machine manufacturer said, "That plastic case would break all to pieces if you dropped it." True, indeed; but what happened to the metal case? It did not break, but it was ruined and of no value for further use. Frankly, we have seen plastic materials or pieces subjected to abuse to which they would not normally be submitted—hardly a justifiable procedure. Then, too, there is the other extreme of snap judgment, not based on actual tests, but on observation of some other manufacturer's parts which might have been improperly designed or moulded of the wrong material.

There are two very definite questions to be answered

before plastics should be eliminated from consideration for apparent brittleness or lack of strength. First, is it properly designed for plastics? Second, is it moulded of the proper type of material? Just as there are many kinds of steel, so are there many kinds of plastics. Custom moulders or plastics manufacturers' representatives know these materials and their proper design. Many problems can be successfully avoided by consulting them first.

Now we come to heat resistance, number six in the list of objections. Some of the latest asbestos-filled phenolic resins withstand a temperature of 490 degrees F. to 500 degrees F. without disintegrating. Of course, plastics will not stand the heat a lot of other materials will stand. But asbestos-filled compounds do stand up under greater heat than any of the others. There are thermo-plastic materials which soften at 150 degrees F., some urea materials that will hold up under 250 degrees F. You can make the phenolics char and blister, but they will not burn, and are still completely fireproof, and they do not conduct heat readily.

Plastics Contribute.

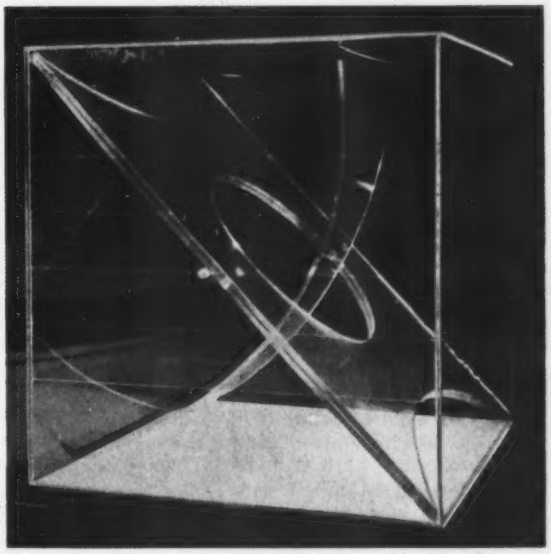
Plastics are not a panacea for all structural problems —far from it. There are many applications which cannot be adapted to plastics, probably never will. But—they should have a fair trial. They do have many combined physical properties which cannot be found in other materials. And plastics can be formulated to do specific jobs which others cannot do; moreover, they are readily adaptable. Plastics have made available to all of us some inventions which we could not have otherwise enjoyed. They have a very definite place in industry and that place is constantly growing.

PLASTICS SCULPTURE

IT was with the purpose of discovering a new technique expressing the capacities of the acrylic plastics as a medium for sculptors that a competition was undertaken last winter, sponsored by the Museum of Modern Art, New York. The idea of the competition was conceived by Gilbert Rohde, industrial designer, who acted as a technical consultant.

The results of this interesting competition are surveyed in an article by Elizabeth Clark in the June issue of *Modern Plastics*, and some very significant conclusions are given after studying the 250 entries. At its first meeting, on February 20, 1939, the jury examined the entries and found that, although there was a generally high artistic quality evident, a number of entries showed lack of understanding of the medium. The problem in many cases had not been studied through to its logical conclusion. Many attempted to portray subjects which would have been more fittingly executed in wood or clay. Others attempted designs which were either too difficult or impossible to execute, in the given medium, because of its inherent properties. The fact that the five sketches selected to be executed full size turned out to be abstractions was the result, not so much of the disposition on the part of the jury, as it was that the abstractions considered the quality of the medium first, while the representational designs for the most part placed first emphasis on subject matter and, secondly, on material.

It is interesting to note that in the main the work of the competitors bore a strong relation and likeness to the abstractions of well-known European sculptors, particularly Naum Gabo, whose work was fully described in our February, 1938, issue. According to Gabo's theory, which is known as "The Constructive Idea," his creations are not merely patterns, but experiments in three-dimensional form which exploit the inherent characteristics of the various plastic materials.



Above is Alexander Calder's entry, which received first prize. One intersecting sheet is dark purple, the other is colourless transparent material. Red disc is superimposed on heavy rod. The whole sculpture is illuminated from concealed light source; sheets become edge-lit and extremities of rods show points of light. This sculpture is on display at the Röhm and Haas exhibit at the New York World's Fair. On the right is the fifth prize winner, submitted by Xanti Schawinsky. Thin etched lines are drawn on the surface of a large transparent cube.

ABRASIVE WHEELS

ABRASIVE wheels are used in many industries for cutting, grinding, smoothing, polishing, etc., but little is known of their manufacture.

The abrasive wheels are made of two materials—"abrasive" and "bond." The abrasive particles are the cutting agents, while the bond holds together the abrasive grain. There are two kinds of abrasives, namely, aluminium oxide abrasive, called alundum and carbide of silicon abrasive, known as carborundum.

Alundum wheels are used for metal polishing, while for granite and glass polishing, carborundum wheels are employed.

In the early days of the abrasive wheel industry, the bonding material used was generally clay-feldspar, which was thoroughly mixed with the ground abrasive material by means of water. The technique of manufacturing wheels from this mixture was more or less the same as used in the pottery industry. The wheels were cold moulded to the desired size, shaped with suitable cutting tools and vitrified in a kiln at about 1,250 degrees C. This process was called the vitrifying process. Even to-day, about 45 per cent. of all the grinding wheels produced are still manufactured by this process.

The speeding up of manufacturing methods in all industries has naturally led to the development of high-speed grinding technique which requires an elastic type of wheel that would stand up to heavy service and not break under strenuous conditions of use. Clay, on baking, becomes rigid and is comparatively brittle. The grinding wheels made with this bond have no elasticity, lack strength and are susceptible to fracture easily. Attempts have therefore been made in the past two decades to replace clay with some other suitable bonding medium. Nowadays, besides clay, four other materials are used as bonds of the abrasive grain.

Silicate Process

In this process, the abrasive is mixed with sodium silicate and some ceramic filler, tampered into mould to the desired shape and size and baked in electric oven at 225-250 degrees C. About 20 per cent. of the wheels are made by this process.

Rubber Process

The abrasive material is compounded on mixing rolls with a rubber sulphur compound and calendered to required thickness. The wheel is die-cut to proper shape and size and cured in electric oven at 140-160 degrees C. Five per cent. of the wheels are bonded with rubber.

Bakelite Process

Phenol-formaldehyde resin is mixed with the ground abrasive exactly as in the manufacture of moulding powders where the resin is intimately mixed with fillers. Both wet and dry mixings are quite common in the industry. The wheels are moulded in the cold to the desired shape and size, set under pressure and baked in an electric oven at about 160-180 degrees C. Twenty per cent. of wheels are made with phenolic resins.

Shellac Process

The technique of manufacturing shellac bonded abrasive wheels is somewhat different from those already described. The abrasive, in this case, is first heated at 170-180 degrees C. for approximately 12 hours and mixed with requisite amount of shellac in a kneading machine. The quantity of shellac required varies with the type of the abrasive material, but generally between 5 to 20 per cent. of the mass of the abrasive wheel is sufficient. The toffee-like material from the kneading machine after cooking is crushed and sifted. The granulated material is then packed in a steel mould corresponding approximately to the desired size of the wheel. Depending on the grit size of the abrasive and the size of the wheel, the mould is then heated either in a hot press or an oven at about 175 degrees C. until the mass is soft.

Since all heat has to be absorbed through the steel surroundings of the wheel, the length of the time required to heat the mould naturally varies between wide ranges, depending on the dimensions of the wheel.

When the granulated material has become sufficiently plastic, the mould is removed from the oven and subjected in a hydraulic press to sufficient pressure, which again varies with the grit of abrasive material from one to three tons per square inch. The mould is then thoroughly cooled and the wheel removed from it. After standing for three to five days at room temperature, the wheel is embedded in sand and baked in an oven. The oven is gradually heated to 175 degrees C. over a period of about two days and held at that temperature for 10 to 12 hours. After cooling, the wheel is finally turned on a lathe to size.

Recently, cold mixing of shellac with the abrasive material has been tried. In the case of fine grit wheels, water-cooled ball mills are used for mixing finely powdered shellac with the abrasive, while rotating mixing pans are generally employed for coarser grits. Usually a little linseed oil is added in the case of coarser grits to prevent the separation of shellac from the abrasive material. The mixture so obtained is then handled in exactly the same manner as with hot mixings.

This procedure has been successful with very fine grit sizes, but causes occasional swelling with coarser grits. Wheels having a tendency to swell are generally bolted between plates prior to baking.

Heavy service abrasive wheels designed to be used at high speed without cooling with water or any lubricant are generally bonded with phenol-formaldehyde resin, whereas those required for precision grinding are made with shellac. The higher softening point and complete infusibility of Bakelite after baking is an admitted advantage over shellac and suits the wheel bonded with this medium admirably for heavy service work.

Another advantage of using the synthetic resin is that the mixture can be cold mixed and cold moulded.

Shellac-bonded wheels, however, have certain properties which are greatly appreciated in certain grinding processes and make them indispensable, especially in precision grinding, such as the grinding of lenses, razor blades, etc. Apparently, the slight softening of the resin at high speed gives to the wheel elasticity and power to resist fracture and is an advantage over Bakelite in these cases. The most serious competitor of the shellac-bonded wheel is met in the rubber-bonded one, but comparatively rapid deterioration of the latter under certain conditions of use limits its employment in many spheres.

RUBBONE—NEW OXIDIZED RUBBER

RUBBONE is a special form of oxidized rubber possessing a unique combination of desirable technical properties, originally developed and patented by the Rubber Growers' Association and manufactured and marketed in this country by Scott Bader and Co., Ltd., 109, Kingsway, London, W.C.2.

Raw rubber is an unsaturated and unstable compound. It was regarded as an interesting, but nearly useless, curiosity till vulcanization, the chemical addition of sulphur, was discovered a century ago. Now the rubber industry ranks among the most important in the world with an output of about a million tons per annum. Vulcanization or sulphurization confers stability to rubber as well as resistance to heat, chemical reagents and ageing.

Oxygen is in the same chemical group as sulphur. It is, therefore, not surprising that attempts to produce an oxidized rubber have been made from time to time. The difficulties of production have, however, always been too great. Now success has been achieved at last.

The oxidation of rubber to form Rubbone is protected by world-wide patents. The immense technical advantages which accrue from vulcanization are reflected in the advantages derived from oxidation, although, of course, these advantages lie in altogether different directions from vulcanization. Oxidized rubber ranks only second to vulcanized rubber in importance.

Varieties of Rubbone

The oxidation, like vulcanization, must be carried out under strictly controlled conditions. This is achieved in a series of steps, one of which involves catalytic oxidation, culminating in the production of a compound having substantially the chemical formula of $C_{10}H_{16}O$. It is possible by directing the course of the reaction to secure three different varieties of Rubbone, designated as Rubbone A, Rubbone B, Rubbone C, most easily distinguished by their solubilities.

Polymerized Rubbone A and Polymerized Rubbone B are tough gels, like a tung-oil gel, insoluble and substantially infusible, although they become rubbery on heating.

Polymerized Rubbone C, which is termed Rubbone D, is tough and semi-flexible, insoluble and substantially infusible, although it becomes rubbery on heating.

Oxidized Rubbone C, which is termed Rubbone D (hard), is much more fusible and substantially insoluble, although it becomes rubbery on heating.

Viscosity

The viscosity of Rubbone A increases progressively by polymerization, by which process it becomes Polymerized Rubbone A; it decreases by oxidation to Rubbone B. Similarly, the viscosity of Rubbone B increases progressively by polymerization and it becomes Polymerized Rubbone B. The gradual oxidation or polymerization of Rubbone C to Rubbone D leads to a progressive increase in viscosity till eventually insolubility occurs.

Vulcanization

Rubbone A, B and C may be vulcanized in the same way as raw rubber, save that less sulphur is required. Rubbone A is the most suited to vulcanization, although Rubbone B vulcanizes quite readily. Accelerators have the same effect as with raw rubber. The addition of silica produces an extraordinary toughening effect more than doubling the tensile strength. Further details may be had on application.

Characteristics of Rubbone B

Appearance	Yellowish viscous resin which becomes lighter in colour with increasing oxidation.
Acid value	5.
Saponification value	60.
Iodine value	305.
Specific gravity	0.966 @ 27° C.
Refractive index	1.519 @ 28° C.

Breakdown Voltage of Impregnated Materials

Tissue paper and press board impregnated with Rubbone B and baked—about 650 volts per 0.001".

Tissue paper impregnated with Rubbone-stand oil varnish and baked—about 1,500 volts per 0.001" at 100° C.

This figure is decreased to about 1,100 volts per 0.001" on keeping for 24 hours at 95% relative humidity.

Asbestos boards made by laminating Rubbone B treated asbestos paper and pressings at 230° C. at 1,000 lb. in ^{3} gave a breakdown voltage of 100 volts per 0.001".

The excellent water resistance of Rubbone makes it particularly valuable where electrical apparatus operates under conditions of high humidity. The electrical characteristics of all the Rubbones are of a similar order.

Hardening Temperatures

On exposure to air at room temperature Rubbone A, B and C harden on the surface. On heating, Rubbone becomes quite fluid at 100 degrees C. Continued heating induces a rise in viscosity till eventually polymerization is complete and the insoluble end-product, Rubbone D, is obtained. Hardening is complete at

100 degrees C. in 50 hours.
140 degrees C. in 24 hours.
200 degrees C. in 1½ hours.
300 degrees C. in few seconds.

Rubbone resists 350 degrees C., but some loss in weight occurs if it is maintained at this temperature.

As with tung oil, in contact with air the hardening is partially caused by oxidation. Heated out of contact with oxygen, the final product is a tough elastic gel. For convenience, both these end-products are described as Rubbone D.

Impregnation

It will be appreciated how valuable are these characteristics for the impregnation of substances such as asbestos. The low viscosity and the high wetting power of Rubbone B at, say, 100 degrees C. allow porous substances, armature windings and the like to be impregnated easily. Continued heating subsequently converts the outer portions to a hard skin, leaving the interior in the form of a tough elastic solid. No solvents are used, consequently there is no trouble with vesiculation, toxicity, solvent recovery or fire risk.

PRODUCTION

Practical Information dealing with Raw Materials, Moulding and Forming of all types of Plastics—Thermo-Hardening and Thermo-Plastic—Works-Organization, New Plant and Control Apparatus

NOTES AND COMMENTS

International Standards

ON another page in this issue there is published a short account of the standard specifications that exist in this country. It was read at a recent Plastics Conference in Paris. It is apparent that the number of standard specifications is small, but the argument can be submitted that, under present conditions in the industry, it is extremely difficult to increase them or, at least, increase them and use them with effect, for standard specifications are useless unless they are in fact employed by manufacturers to control production. The industry is at present too fluid to confine its products by additional hard and fast specifications.

Judging from other papers that were read, many other countries are in a similar position. Germany has more specifications, but one is permitted to doubt the advisability of this condition, especially since there is probably more movement in that country in regard to the rapidity with which new plastics are made and the modification of old ones, than elsewhere.

One speaker ventured a hope that it would be possible soon to gather sufficient information to make feasible the construction of international standard specifications. Such a consummation is devoutly to be hoped for. There can be little argument against such an idea. It would be as fruitful to world industry as national specifications are to the individual country's business.

The international scheme, however, must be dependent on the national one and since manufacture is, as already pointed out, continually improving and by no means static, there seems little hope for international conferences.

It is generally true that those most insistent on the need for international standard specifications are the scientists without much knowledge of the economic factors involved. What they really mean is the need of internationally standardizing methods and apparatus. This is readily understandable, for at present it is almost impossible to translate German or French or any other nation's figures into English ones. The conditions, sizes of test pieces, etc., are simply not known in this country except by those who have made it their special business to find out.

What then is possible and even urgent is the calling of international conferences for the standardization of tests, apparatus and nomenclature. We must talk the same language before further steps are taken.

New Plant for Dry Shaver Manufacturer

ON the day we go to press we have been invited to attend the works of Rolls Razor, Ltd., to see the manufacture of the world's first non-electric dry shaver —the Viceroy. Presumably it works mechanically, and, in consequence, is quite independent of varying voltages. We always wondered how the modern airway traveller to America shaved himself with the electric type.

We have already indicated in these pages the rapidity with which this general type (they have all been electric hitherto) has swept the world. Perhaps in a few years shaving soap will be just a memory!

It is well known that all these new electric razors possess a plastic holder, made either of phenol-formaldehyde or urea resins, not only because of the simplicity and beauty of the finished mouldings, but also because of their electrical properties. The Viceroy is no exception and has been supplied with a moulded holder produced in urea resin by the ordinary compression process. But a new development about to take place is more than of passing interest. New plant is being installed for the production of the holder by the injection process, replacing, we presume, thermo-setting resin with a thermo-plastic one. What this latter is we do not yet know, but, obviously, since there is no internal motor, the need for a material with high electrical resistance is not necessary. Dimensional stability is of paramount importance.

British Standard Specifications*

THE difficulties under which the plastics industry in Great Britain has laboured are, it may be presumed, very little different from those that have existed in other countries. The very youth of the industry, the peculiar nature of its products from the physical and chemical point of view and the rapidity with which new products and combinations have been produced, have all made the building up of specifications of real value extremely difficult. To-day many of the same difficulties are still with us, and although there exists in Great Britain a number of standard specifications, some materials remain without standardization.

Phenol-formaldehyde Plastics

The materials which have received closest attention are, naturally enough, the phenol-formaldehyde resins, because they are the most widely used and because of their long-continued interest to the electrical industry. In 1929 there appeared B.S.S.316, dealing with synthetic resin varnish paper boards and tubes, Grade II (low resin content), while in 1934 B.S.S.547 dealt with the same material of high resin content, Grade I. The tests on these materials are almost identical and include electrical tests, mechanical tests, water absorption and effect of hot oil. Grade I also undergoes a test for surface insulation after a tropical conditioning process. Both of these specifications are widely used by manufacturers of heavy electrical machinery.

In 1936 there appeared B.S.S.668, again dealing with laminated plastics. In this instance the material is of fabric base and for use as gear material. The tests carried out are: finish, tolerance on dimensions, density, tensile strength, resistance to compression, toughness, cross-break strength, machining, water absorption and the effect of hot oil.

The first reference to moulding materials was in B.S.S.488, 1933—"Moulded insulating materials suitable for accessories for general electrical installations." This did not specify synthetic resins, but included all materials for the purpose in view, with the exception of ceramics. It included four grades, the basis of classification being the tendency to deform at elevated temperatures, 55 degrees, 70 degrees, 100 degrees and 140 degrees C. The tests carried out under this specification are plastic yield, electric strength, surface resistivity, impact strength (Charpy), cross-break strength, compressive strength and water absorption.

This specification came under some criticism, both from manufacturers and users, and is now under revision.

The first specification dealing solely with phenol-formaldehyde moulding powders and mouldings was B.S.S.771, of 1938. It is important to note that it represents the first collaboration of the British plastics industry with the British Standards Institution, for it was the British Plastics Federation that realized the need and drew up the draft specification that formed the basis of the final one. We have in B.S.S.771 one that deals reasonably adequately not only with the raw materials for moulding but also with the finished mouldings themselves.

The finished mouldings are here tested for freedom from defects, density, degree of cure (acetone extraction) and finish.

The moulding powders are classified under five headings:—

G	General type.
GX	Improved type.
MS	Medium shock resistant type.
HS	High shock resistant type.
HR	Heat resistant type.

The electrical and mechanical tests carried out on these are very similar to those carried out in B.S.S.488. In addition, the heat resistant type is tested for resistance to crushing after heating to high temperatures.

It must be pointed out that the methods of tests themselves must be carefully examined before the figures given are compared with those specified in other countries.

As examples we can quote HS and HR materials.

	HS.	HR.
Ultimate tensile strength ...	6,000 lb./sq. in.	3,500 lb./sq. in.
Impact strength (Izod)	0.90 ft.-lb.	0.07 ft.-lb.
Water absorption	350 mg.	100 mg.
Electric strength at 90 degrees C.	20 volts/mil.	20 volts/mil.
Surface Resistivity after water immersion ...	100 megohms.	100 megohms
Resistance to crushing after heating to 400 degrees C. in bath of fusible metal	—	500 lb.

Amino-plastics

There exists at present no British Standard for amino-plastics, but two principal manufacturers are preparing the ground for a specification. They will probably follow the general lines of B.S.S.771, but with modifications, such as thinner test pieces, the replacement of the acetone extraction test after curing by a scratching test following immersion in water, etc.

Some of the proposals are as follow:—

Tensile Strength.—Test piece as in B.S.S.771, but reduced by $\frac{1}{8}$ in. all over. Standard as for GX phenolic. 7,000 lb./sq. in.

Impact Strength.—No agreement has been reached, but results are about the same as on a good wood-filled phenolic under the same tests.

Water Absorption.—As B.S.S.771, but higher figure about 350 mg. will have to be allowed.

Electric Strength and Surface Resistivity.—As B.S.S.771. Electric strength similar to phenolics, and surface resistivity is generally better.

Flow of Moulding Material.—The cup flow method is

* The above notes were read at La Maison de la Chimie in Paris on June 12 by Mr. M. D. Curwen on the occasion of the recent Plastics and Synthetic Resins Conference. They were compiled at the request of Mr. Kenneth Chance, chairman of British Industrial Plastics, Ltd., whose help, and that of others in the British plastics industry, is gratefully acknowledged by the writer. His work, in effect, consisted in little more than "stringing together" the notes of others.

not suitable for amino-plastics. Perhaps some type of flat disc method may be adopted.

Resistance to Electrical Tracking.—In view of the non-tracking properties of amino-plastics some tests for this will be included. A simple type of test is being considered in which two metal studs inserted about 1½ ins. apart in a flat moulding are connected to a 230-volt A.C. supply choked to about 10 amps., and the circuit completed by pouring 10 per cent. salt solution on the moulding. Amino-plastics should not track, even after repeated application.

Cellulose Acetate.

This material and celluloid are so different chemically from all other thermo-plastics that it is worth while repeating in full the information regarding standards given by one of the producers in Great Britain.

There are very few British Standard Specifications for plastics made from cellulose esters. The reasons for this are three-fold:—

(a) Manufacturers are in some cases unwilling to adopt specifications for materials which are still in process of development and improvement.

(b) Cellulose ester plastics are not chemical individuals, and therefore tolerances must be allowed not only in the chemical composition of the ingredients, but also in the proportions and even the identity of the plasticizers. This opens such a wide door that a specification becomes of little use.

(c) Cellulose ester plastics are used for a variety of purposes. A specification which would be acceptable for a plastic required for one particular purpose would usually be at fault for the same plastic if required for another purpose.

It follows from this that the service which standardization authorities can render to the plastics industry lies more in defining the properties which are required for particular purposes than in standardizing individual plastics, and it may be pointed out that the adoption of this principle gives much better opportunities to new plastics, which can then compete on equal terms with old-established plastics.

The British Standard Specifications dealing with cellulose ester plastics are:—

2D.50.—Cellulose acetate.

F.56.—Transparent sheets for observation panels.

B.S.S. 2D.50. Cellulose Acetate.—This specification is for cellulose acetate base, and includes tests for stability to moisture and heat, water content, filming capacity, acidity, ash and viscosity. Methods of applying these tests are described in appendices.

This specification defines a good merchantable cellulose acetate, suitable, for example, for high-quality dope manufacture, but it cannot be regarded as guaranteeing a quality suitable for high-grade transparent sheet.

B.S.S. F.56. Transparent Sheets for Observation Panels.—The title of this specification does not indicate that it applies to cellulose acetate, but the first clause runs:—"1. Type of Material.—The sheets shall be made from a stable variety of cellulose acetate and suitable softening or plasticizing agents." The remaining clauses deal with freedom from defects, dimensions, selection of samples, transparency, freedom from brittleness, rigidity, resistance to extremes of temperature, resistance to moisture, combustibility and resistance to accelerated ageing Not one of the tests described is specific to cellulose acetate, so that, apart from the first clause, this specification defines properties required rather than an individual plastic. It is now being revised.

There is an Air Ministry Specification D.T.D.315 for pigmented Cellulose Acetate Sheets, which follows the general lines of B.S.S. 2D.50.

There are also various confidential Government specifications for celluloid and cellulose acetate products, the contents of which cannot be published. These have been and are still negotiated between the manufacturer and the Government departments using plastic materials.

Methyl Methacrylate.

The following relates to Diakon and Perspex, both thermo-plastics made by an English concern and based on methyl methacrylate. The former is in granule form for moulding, and the latter is in cast rod or sheet form. No British standards exist, but the manufacturers carry out tests to their own specifications, and in the case of Perspex sheet there is an Air Ministry specification in use, D.T.D.339a.

Cast Sheet.—Apart from specification of surface appearance and thickness, this sets limits for the loss of light by absorption and reflection, the tensile strength, the rate of burning, the impact strength (as measured by a ball falling on to a sheet supported in a specified manner), change in dimensions and transparency after soaking in water and after heating and after exposure to arc light.

The specified limits are:—

Tensile strength	...	Greater than 2.75 tons/sq. in., less than 4.25 tons/sq. in.
Light transmission	...	Not less than 90% after all treatments.
Change of dimensions	...	Not greater than 0.5% after all treatments

The burning rate and the specified height of fall for the ball naturally vary with the thickness of the sheet, but as examples the figures for 5/32 in. thick sheet are:—

Time to burn down 6 ins. of 1 in. wide not less than 13 minutes.

Material must not fail when 130 gram ball is dropped 2 ft. 11 ins.

Material supported on steel supports at three points distant 3½ ins. from each other.

The tensile and compressive strength of Perspex vary with temperature as follow:—

	Ultimate Tensile Strength.	Proportional Limit in Compression Strength.
−60°C. ...	6.2 tons/sq. in.	...
−40°C. ...	6.1 ,,	... 11.0 tons/sq. in.
−20°C. ...	5.7 ,,	... 7.2 ,,
0°C. ...	4.9 ,,	... 5.5 ,,
20°C. ...	3.7 ,,	... 4.4 ,,
40°C. ...	2.5 ,,	... 2.1 ,,
60°C. ...	1.4 ,,	... 1.8 ,,

The proportional limit instead of the ultimate strength is given in compression, since at the higher temperatures the material does not fracture under increasing loads, but merely flows.

Moulding Powders.—Certain of the methods of test and test pieces specified in B.S.S.771 for phenolic moulding powders are applicable, but the moulding conditions have to be adjusted, and the moulds cooled before ejecting the specimens. The heat resistance is conveniently measured by means of the Martens test. Typical figures for Diakon are given on the next page.

Properties of Methyl Methacrylate Resins

		Diakon F.
Specific gravity		1.19
Bulk density		0.7
Bulk factor		1.7
Water absorption (seven days)...		0.24-0.30
Shrinkage on moulding		0.002-0.006
Martens point (°C.)		55-60
Tensile strength (lb./sq. in.) ...		8,200-10,000
Impact strength (as B.S.S. 771), ft. lb.		0.30-0.35
Ultimate fibre stress in bend lb.		11,000-14,000
Brinell hardness		19-21
Surface resistivity, megohms ...		$>10^{10}$
Volume resistivity, megohm cms.		$>10^{9}$
Permittivity at 5 × 10^7 cycle	At 20° C. and 75% humidity	2.6
Permittivity at 5 × 10^6 ,,		2.9
Permittivity at 5 × 800 ,,		3.6
Permittivity at 5 × 50 ,,		4.0
Power factor at 5 × 10^7 ,,		0.022
Power factor at 5 × 10^6 ,,		0.019
Power factor at 5 × 800 ,,		0.033
Power factor at 5 × 50 ,,		0.038
Dielectric strength at 20° C. ...		280-300
Dielectric strength at 70° C. ...		280-300

The material retains its impact strength practically unaltered down to a temperature of −60 degrees C.

With coloured Diakon, as with urea-formaldehyde, it is probable that a colour permanence test will be considered in drawing up any British Standards, since perfect colour stability can be obtained by choice of stable colouring materials.

Polystyrene.

Here there are no official standard specifications at all in this country. The following figures represent the unofficial standard to which one British manufacturing concern works:—

Moulding Conditions.

Compression moulding temperature	140-180°C.
Compression moulding pressure...	1,500-500 lb. per sq. in.
Compression ratio	1.93-2.05
Mould shrinkage	About 5-1,000" to the inch
Injection moulding temperature	170-200°C.
Injection moulding pressure ...	1½-10 tons per sq. in.

Physical and Mechanical Properties.

Specific gravity	1.05
Refractive index (n_D^{20}) ..	1.62
Specific heat (cal. per °C. per gram)	0.324
Thermal expansion (per °C.) ...	7.2 × 10^{-5} (−10° to 45°)
Softening point: Martens ...	87°C.
Distortion temperature ... ... (A.S.T.M. D.48-37)	80-90°C.
Thermal conductivity	1.9 × 10^{-4} cal. per sec. per sq. cm. per 1°C. per cm.
Tensile strength	2.7-3.0 tons/sq in.
Elongation	0.5-1%
Modulus of elasticity, lb. per sq. in. × 10^5	5.5
Compression strength: tons per sq. in.	7 tons
Flexural strength: tons per sq. in	3-3½ tons
Impact strength:—	
Izod, notched bar (ft. lb.: 25° C.)	0.25 to 0.3
Izod, notched bar (ft. lb.: −70° C.)	0.25 to 0.3
Brinell No. (2.5 mm. ball, 25 kg. load)	20 to 30
Rockwell hardness No. (½ in. ball, 60 kg. load)	90 to 97
Rockwell superficial hardness (¼ in. ball, 15 kg. load) ...	15 × 90
Light transmission through 0.1-in. plate	90%
Water absorption in 48 hrs. ...	nil
Effect of ultra-violet radiation...	yellows slightly
Effect of dilute acids	none
Effect of alkalies	none
Effect of H_2O_2 100 vol.	none

Electrical Properties

Frequencies.	S.I.C.	Loss Factor.
50	2.2	0.0002
1000	2.2	0.0005
200000	2.1	0.00044
650000	2.1	0.0002
1000000	2.3	0.0002
40000000	2.3	0.0001
Breakdown voltage (50 cycles, volts per mil.)		500-700
Volume resistivity		$>10^{17}$
Surface resistivity		$>10^{16}$

[Note: Many of the above tests have been carried out on Distrene, a polystyrene made by a British manufacturer.]

Vinyl Plastics.

Here again there are no standard specifications, and the only data available to us are certain physical and chemical constants for the Gelvas, Alvars and Formvars. These are derived from vinyl acetate.

Gelvas.

Dielectric strength	1,000 volts/mil
Dielectric constant (30°C.) ...	2.7
Coefficient of linear expansion	0.000086
Water absorption (A.S.T.M.)...	2.0

There are seven Gelvas manufactured, varying in softening point from 65 degrees C. to 196 degrees C. The harder Gelvas have a tensile strength of 5,000 lb./sq. in.

Alvars

These plastics resemble closely the Gelvas in electrical properties and water absorption. Five are manufactured, varying in softening point from 120 degrees C. to 180 degrees C. The Alvar with 170 degrees C. softening has a tensile strength of 7,500 lb./sq. in.

Formvars

Dielectric strength ...	100 volts/mil.
Dielectric constant (30° C.)	3.7
Tensile strength	14,600 lb./sq. in.
Water absorption ...	1.3
Softening points (two varieties)	190° + and 250° C. +

The Formvars are employed for moulding powders, sheets, rods and tubes and for the manufacture of safety glass.

General Comments

The foregoing notes constitute a résumé of the British Standard Specifications that are available and of some of the specifications employed by certain manufacturers for controlling the material they make.

In addition, there are also specifications issued by certain Government departments, and other big consumers, to cover their own specific requirements. These follow generally the standard specifications, but, for obvious reasons, differ on occasion. For example, the Air Ministry ask for a thick moulded plate, which is

cut up into specimens for testing. Specimens may be cut from the very centre of the plate. Some criticism has been levelled against this method as being too stringent, but this may be countered that stringency must be expected in dealing with aeroplane parts.

There is, in fact, a criticism regarding the specifications in general, namely, that they are tests of moulding rather than of tests on the moulding powder. It has been said that it is unfair to expect powder manufacturers to mould as well as expert moulding manufacturers, and, moreover, that more exact conditions of moulding should be defined. There are many tricks in the trade which influence the final properties of the moulded object. So much, too, depends on the type of press available.

The experience of the G.P.O., however, is interesting. When a powder is submitted in order that it may be placed on the Approved List, the G.P.O. state that specimens submitted may be moulded by the manufacturer or any moulder he chooses, although in general the powder manufacturer will wish to make them himself for purposes of control and convenience. When the powder is placed on the Approved List, the moulder who wishes to supply finished goods made from it must convince the G.P.O. that he can produce satisfactory mouldings. There is thus a double check. An official of the G.P.O. informs me that the moulding produced by the powder manufacturer is, on occasion, better than that produced by the moulding concern.

Whilst on the subject of the G.P.O. it is worth while noting some of the tests they carry out. Generally they follow B.S.S.771, but for special objects special tests are made. Thus for the guard and plunger of the modern telephone an additional impact strength test is made on the whole piece, and is reported as such and not calculated on unit area. The blow on the guard, for example, is given at right angles to the horn at one spot. It is now, perhaps, well known that cellulose acetate guards are now used for the black telephones and "acrylic" acid resins for the coloured ones.

Colour fading tests are carried out now that coloured telephones are widely used. The mercury lamp which was originally used for the test has proved useless because of its narrow band of light, and has given place to the carbon arc.

A new telephone apparatus, the Swedish type, is now being issued, but the method of testing has not yet been decided upon. It is not known yet where the main strains will occur.

Summing up, it may appear from the few British Standard Specifications in existence that the plastics industry in Great Britain is not a very lively one. The truth is quite the reverse. In actual production figures Great Britain is probably third on the list of producing countries; new machines are being widely adopted, and new methods and even new materials are accepted fairly readily. The lack of specifications may reflect some conservatism, but also the realization of rapidly changing conditions. Specifications in important respects mean a static condition, which, in effect, is not really present in the industry. For example, we all know of the new phenol formaldehyde material made by impregnation of fibre with emulsions of synthetic resin, and which, when properly made and moulded, is a considerable advance in many ways on ordinary moulding powders. This is now being used to good purpose in England, although in small quantities. Were it to become widely used the value of B.S.S.771 would be doubtful. It is interesting to note that while it was considered necessary only some six months ago to employ a pressure of 3 tons per sq. in. when compressing this material, further study has improved the process, so that only 1-1½ tons per sq. in. need be employed. Again, only in the last few months there has appeared on the English market an "ethylene" polymer, which, from many points of view, is a great advance on certain plastics which have been used in the electrical industry only during the past year or two.

One might say that sometimes the advances are too rapid to make national standard specifications for a material that might be superseded before it is properly established.

On the other hand, it cannot be too strongly urged that the economic health of the industry depends upon standard specifications. Furthermore, they foster confidence between manufacturer and consumers.

PLASTIC ART IN NEW YORK.

The whole of this decoration is built from Cristaplem, a cellulose acetate which resembles transparent marble. It is in the French Pavilion at the World's Fair.

Inquiries and Answers

Transparent Bottle Tops

Grimsby.

The Editor, *Plastics*.

Dear Sir,—We are interested in obtaining transparent sheet suitable for taking the place of glass in the tops of sample containers.

We send you herewith a sample of the metal portion of the top, and would advise you that the glass or transparent material will be kept in place by a strip of cork placed round the inside at a later stage.

Will you please put the inquiry forward to firms who are likely to be in a position to supply a suitable material—either in circles to fit our metal top or in sheet form from which the circles may be punched. We should much prefer a non-inflammable material, and it should be stated whether the samples submitted are inflammable or not.

THE BRITISH ISINGLASS CO., LTD.

[EDITOR'S NOTE.—The metal portion enclosed is an annular ring 1.8 ins. in diameter fitted with a lip. All that is required by the reader is a flat disc slightly smaller than this, in celluloid or cellulose acetate. Manufacturers of the sheet:—

Celluloid	... ...	BX Plastics, Ltd.
Cellulose acetate	...	BX Plastics, Ltd.
		Erinoid, Ltd.
		May and Baker, Ltd.

It seems a pity that a strip of cork should be included and so increase cost. Perhaps the above manufacturers can suggest a suitable cement to keep the metal and plastic disc together or, better still, it does not seem inconceivable that an entirely transparent top, moulded from cellulose acetate, should be possible. The whole appearance of the container would be vastly improved.]

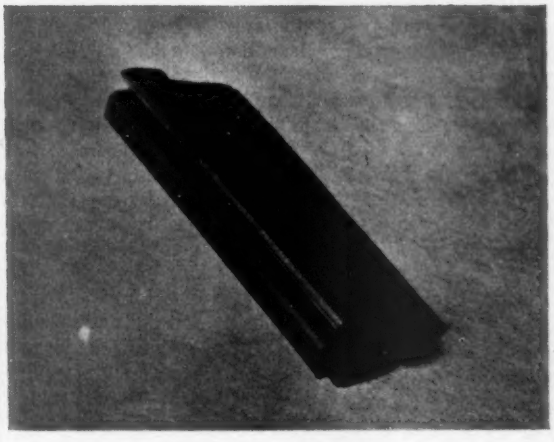
Sliding Fasteners

Dublin.

The Editor, *Plastics*.

Dear Sir,—I am looking for a plastic substance that can be produced in all colours, moulded to shape of enclosed sample, and have almost the pliability of rubber. I have been granted a provisional patent for a "Slide Fastener," and am anxious to know if I could get a plastic material before I go ahead with the manufacture in another substance.

J. G. MANGAN,
Irish and Czechoslovakian Trading Company.



[EDITOR'S NOTE.—The only materials we can suggest are Mipolam, the poly-vinyl chloride resin made by F. A. Hughes and Co., Ltd., and Polythene, the new polymerized ethylenic resin manufactured by I.C.I., Ltd. Both resemble rubber in texture and, moreover, are capable of being made in a variety of bright colours. These concerns would be able to indicate manufacturers who are able to extrude the raw material into the desired shape.

Samples of the above materials have been sent to the inquirer.]

Novelty Mouldings

Bristol.

The Editor, *Plastics*.

Dear Sir,—One of our clients, manufacturers of A.C. electric motors, has asked us to obtain quotations for the supplying of miniature motors to be sent to their various customers as a novelty paper weight or pin holder.

It would be very much appreciated if you could put us in touch with a firm likely to manufacture this class of novelty.

WALTER PEARCE AND CO., LTD.

[EDITOR'S NOTE.—We are reminded by this interesting request of the miniature motor made and issued by Brook Motors, Ltd., last year, a photograph of which we published in our December, 1938, issue. Concerns who could mould are:—Ashdowns, Ltd., Birkbys, Ltd., BX Plastics, Ltd., Crystalate, Ltd., Ebonestos Industries, Ltd., Forbes Plastic Mouldings, Ltd., Inlay Mouldings, Ltd., London Moulders, Ltd., and Rootes Mouldings, Ltd. Moreover, they could help in the design in order to produce the most economic model.]

Cellulose Acetate Mouldings

Rayleigh.

The Editor, *Plastics*.

Dear Sir,—Would you kindly tell us the names and addresses of any firms who undertake cellulose acetate mouldings?

We are in the market for some acetate moulded containers—quite small ones.

A. E. PERKINS AND CO.

[EDITOR'S NOTE.—Most of the big compression moulding firms now undertake cellulose acetate moulding by the injection process, e.g.:—

Ashdowns, Ltd.
BX Plastics, Ltd.
Crystalate, Ltd.
Ebonestos Industries, Ltd.
Fraser and Glass, Ltd.
Punfield and Barstow, Ltd.

On the other hand, if shaping from the acetate sheet is desired, the following firms should be approached:—G. H. Gregory and Co. (Plastics), Ltd.; Hadley Co., Ltd.; Plastilume Products, Ltd.; Phipps Plastic Products, Ltd.]

Plastics and Education

Plymouth.

The Editor, *Plastics*.

Dear Sir,—I thank you for the copy of *Plastics* which you sent me on May 8, and which I find extraordinarily interesting. I should like to arouse interest in this subject in the educational world here, and desire to make a request, which, I am sure, will receive at least your sympathetic consideration.

Could you put me in touch with some manufacturer, or association of manufacturers of plastics, who could send a small exhibition of plastic products to this School of Art? Together with this, I should be most glad to hear of such an association which might on application send a lecturer on this progressive industry. I could guarantee an audience of at least 120, made up of architects, painters and decorators, teachers and general art students. I should like such an occasion to take place in the autumn of this year, say, in October.

PRINCIPAL,
School of Art, City of Plymouth.

[EDITOR'S NOTE.—I think the inquirer had best get in touch with any or all of the following three firms:—Imperial Chemical Industries, Ltd., Millbank, London, S.W.1; British Industrial Plastics, Ltd., 1, Argyll Street, London, W.1; Bakelite, Limited, 40, Grosvenor Place, London, S.W.1. The last two firms have films illustrating the manufacture and use of plastics, which, I feel sure, they would be glad to show.]

What Are These?

In our June issue we published two old plaques which we had been sent with the request that their origin may be discovered. To our great pleasure we have received the following letter from the well-known French concern of moulders, Manufacture d'Isolants et Objets Moulés.

Vitry-sur-Seine.

The Editor, *Plastics*.

Dear Sir,—The two moulded plaques illustrated on page 198 of your June issue have been made by our firm, the Manufacture d'Isolants et Objets Moulés de la Compagnie Générale d'Electricité, at Vitry-sur-Seine, about 1910. The material, "bois durci," was a mixture of wood flour and blood fibrine; the blood was supplied by the Paris abattoirs.

In spite of a few remarkably good qualities, this material has been superseded long ago by the phenol-formaldehyde materials.

MANUFACTURE D'ISOLANTS ET OBJETS MOULES.

[EDITOR'S NOTE.—They are not as old as we first thought, but they are old enough. Moreover, they are in an excellent condition and as hard and as tough as one could wish. The fact that they were made of wood-flour and blood-fibrine is most interesting, since we believe the Argentine is endeavouring to promote the latter raw material for moulding purposes.]

Gear Wheels

Manchester.

The Editor, *Plastics*.

Dear Sir,—Could you please give us the names of firms making gearwheels, etc., from plastic materials?

ARTHUR S. WALTHO AND SON.

[EDITOR'S NOTE.—The following firms manufacture plastic gears from circular blanks made from laminated material:—Reliance Gear Co., Dickinson Street, Springfold Lane, Salford, 3; Highfield Gear and Engineering Co., Ltd., Karrier Works, Mile Street, Huddersfield; Greenwoods Standard Gear Cutting Co., Ltd., New Bond Street, Halifax; Ashdowns, Ltd., Eccleston Works, St. Helens, Lancs. We believe that Ashdowns, Ltd., are manufacturing certain types of moulded gearwheels direct from special material, such as Peton. Further information regarding plastic gearwheels may be obtained from Bakelite, Ltd., or Ellison Insulations, Ltd.]

Sponge Rubber Blocks

Leigh.

The Editor, *Plastics*.

Dear Sir,—We should be very glad if you could let us know where to purchase the necessary liquid for producing soft rubber blocks ("Sorbo" substance) from our own moulds.

NATIONAL PELMET AND CURTAIN CO.

[EDITOR'S NOTE.—Jeavons, Tinto and Co., the well-known distributors of rubber latex, inform us that it would be advisable for the inquirers to get into touch with a company such as Dunlop Rubber Co., Ltd. The production of sponge rubber from latex is not simple and it would be best to work an existing process under licence. On the other hand, if the methods are known to the inquirers, rubber latex may be obtained from:—Jeavons, Tinto and Co., 41, Eastcheap, London, E.C.3; Revertex Sales Co., Ltd., King William Street House, Arthur Street, London, E.C.3; Consolidated Rubber (Latex), Ltd., 3, Rood Lane, London, E.C.3; Hilton Wallace and Co., 59, Eastcheap, London, E.C., or St. Dunstan's House, Idol Lane, London, E.C.3; Fincham and Smith, Ltd., 37, Great Tower Street, London, E.C.3.

In our June issue we inadvertently referred to Peter Spence and Sons, Ltd., as supplying this material. This is not so. They are purely chemical manufacturers.]

London, N.19.

The Editor, *Plastics*.

Dear Sir,—The writer read in the daily Press of the company meeting of Messrs. Thomas De La Rue, and the comments by the vice-chairman and managing director with reference to the plastics side of this well-known concern, and was rather surprised at his remarks regarding the rapid expansion of this industry, and that he considered suppliers of machinery and materials unwise in encouraging multiplication of moulding companies instead of concentrating their efforts in assisting and encouraging established businesses, etc., etc.

We think that many readers will agree with us that such a remark could apply to practically every industry, and if carried out would undoubtedly result in what this gentleman desires—a monopoly. It is unnecessary to add that the progress of any new, or even old, industry, is, and always will be, dependent on the small man or pioneer.

The writer could mention two very well-known concerns with whom he started in business, employing three or four men; together, these two concerns must now employ approximately a thousand men, which only goes to prove that the old saying is correct—that the small firm of to-day is the large firm of to-morrow.

In conclusion, we understand that Messrs. De La Rue's plastics section are very active supporters of the Plastics Federation, and we are wondering whether the reason that the smaller concerns refrain from joining is due to the created atmosphere that this Federation desires only the well-established plastics businesses.

N. B. MOULDINGS, LTD.
(Signed) E. C. Bell, Director.

TRADE AND PERSONAL NOTES

The British Xylonite Co., Ltd., have sent us a very interesting brochure describing their new showrooms, 4-7, Chiswell Street, London, E.C.1, which they have re-christened the Plastics Centre. Incidentally, this publication contains a reminder that the British Xylonite Co. was making plastics when our grandfathers were gay young sparks in the 1870s, and their experience is therefore unique in what is generally considered a new industry. The exhibits at the Centre cover the whole field of plastics, and consist not only of raw material from BX Plastics, Ltd., and finished articles, chiefly toilet goods from Halex, Ltd. (these firms being, of course, the newly formed manufacturing subsidiaries of the British Xylonite Co., Ltd.), but also include the products of customers who fabricate BX Plastics' material, or who contract with Halex, Ltd., for finished goods in any type of synthetic resin.

The Plastics Centre would be worth a visit even if there was nothing displayed there! The general interior design is by Mr. Walter Landauer, of Industrial Design Partnership, and he has employed one or other of the BX materials for many fittings and items of furnishing. We cannot catalogue them here—you must go and see for yourself!

The General Council, British Standards Institution, held a meeting on May 9, when, in accordance with the by-laws of the Institution, Sir Frank Heath, G.B.E., K.C.B., resigned the chairmanship and Sir Percy Ashley, K.B.E., C.B., formerly secretary and now a member of the Import Duties Advisory Committee, was unanimously elected as chairman for the ensuing year. The latter assumed office from the date of the annual general meeting, which was held at the Dorchester Hotel, Park Lane, London, W.1, on June 15.

Mr. W. B. Levy, Walt Disney's European representative, will be returning to England from the United States at the end of July, and he will bring with him the first model sheets, illustrations and sculptured figures of "Pinocchio," Disney's full-length successor to "Snow White and the Seven Dwarfs."

At the request of manufacturers throughout the world a new department has been added to the Walt Disney studios in Hollywood. Known as the Sculpture Department, it is staffed by expert sculptors whose job is to turn all new Disney characters into three-dimensional, full-round figures as they are created.

The authentic sculptured models of the "Pinocchio" characters which Mr. Levy will bring back to London with him will be of inestimable advantage to all manufacturers of Disney figures, whether made in plastics, fabric, metal, etc.

British manufacturers are already making advance plans for merchandise based on the "Pinocchio" characters, which will be put into operation immediately the long-awaited Hollywood material is available.

The Foster Instrument Co., Ltd., have issued a new broadsheet which is a unique effort both in size and quality of production. It illustrates the Foster recording pyrometer and dial recorder in actual size and in full colours. On the inside, which opens out to 21½ ins. deep by 31 ins. wide, is a full description with six views of individual sections of the Strip recorder.

The United Insulator Co., Ltd., 12-16, Laystall Street, London, E.C.1, have forwarded us their new leaflets, L.1 and L.2, which deal with the ceramic trimmer condensers. The first publication refers to the company's new Bijou-type trimmer condensers, which are similar in construction to their well-known standard types and which have been so widely and successfully employed in H.F. circuits since their introduction a few years ago; they are, however, smaller in geometrical dimensions and much lower in price; at the same time, they are fully equal, in electrical characteristics, to the corresponding types.

The Cambridge Instrument Co., Ltd., 13, Grosvenor Place, London, S.W.1, have recently issued a folder describing their electrically operated automatic regulators. These are claimed to be suitable for almost any industrial application and are widely employed to control both electric and gas-fired furnaces, the former through the medium of contactors and the latter by means of automatic valve gear. Descriptions and standard specifications are given of an indicating controller, a recording controller and a potentiometer controller.

George H. Alexander Machinery, Ltd., 83-84, Coleshill Street, Birmingham, 4, have forwarded us a brochure describing a new carbide cutting tool known as "Kennametal." The basic ingredient of the steel-cutting grades of "Kennametal" is the new substance corresponding to the chemical formula $WTiC_2$ and covered by U.S. Patent 2,113,353, granted to Philip M. McKenna, of McKenna Metals Co., of Latrobe, Pa., U.S.A. The discovery of this substance, and methods of producing it, has advanced the metal-cutting art, because this compound produces very fine-grained hard-metal compositions not subject to grain growth experienced in the manufacture of previous hard tool compositions. Hard alloys made from it do not "crater" in cutting steel.

The Federation of British Industries has set up a committee to act as a link between industry and the new Ministry of Supply. The chairman is Lt.-Col. Lord Dudley Gordon (president, British Engineers' Association, chairman, J. and E. Hall, Ltd.).

Bakelite, Ltd., have released an interesting 20-page booklet, entitled "The Material of Infinite Uses," which deals with the origin and properties of Bakelite materials and their applications to the demands of various industries. Copies of this brochure are available to readers on application to Bakelite, Ltd., Hobart House, 40, Grosvenor Place, London, S.W.1.

Rhodes and Cartwright describe their well-known R. and C. range of steel requisites for air raid precautions in a recent folder available on application. The articles illustrated include, for example, fire buckets, water containers, air-tight containers for food and decontamination bins.

The Ramsay Laboratory of Chemical Engineering held an exhibition of work at University College, Gower Street, London, W.C.1, on Friday, June 30. As well as various types of plant, the exhibits included lubricating oils, hard lac resin, lac-oil varnishes, water-coating emulsions and a demonstration of shellac spraying.

Halex Ltd.'s nominal capital has been increased by £224,900 to £225,000; BX Plastics by £449,900 to £500,000, all in £1 ordinary shares. The companies are subsidiaries of the British Xylonite Co., Ltd.

E. K. Cole, Ltd., held their annual general meeting at the Palace Hotel, Southend-on-Sea, on June 8, 1939. Trading profit for the year amounted to £34,756. Mr. W. S. Verrells, the chairman, reported that the Bakelite Moulding Department showed a very satisfactory increase in sales during the year under review, but export sales were disappointing. It is hoped to improve this position in the coming year by the release of radio receiving sets which have been specially designed for the export market.

F. A. Ketch and Son, Ltd., 38, Spencer Street, Birmingham, is a new company formed with the object of acquiring the business of a plastic product manufacturer, carried on by F. A. Ketch at the same address. Capital £1,000.

NEW MATERIALS—NEW PLANT—NEW METHODS

Original Pieron Hydraulic Upper-pressure High-speed Presses

We have just received information from Muschamp Taylor, Ltd., Vulcan Works, Pollard Street, Manchester, 4, regarding the well-known German Pieron presses which now embody several important improvements.

The presses are designed in the company's patented framework construction (twist-proof frame case) which offers a protection from any vibration and eliminates any danger of breakage. The upper table and cylinder are of one piece and movable while the piston is stationary. This novel design guarantees a smooth and even gliding up and down of the upper table so that the piston is unaffected by any lateral stress and is therefore of a much longer duration.

The stationary piston has been constructed in the form of a cylinder for the reversing ram, or, alternative to this construction, the presses are provided with counter-pressure pistons.

The guiding of the upper table is positive and provides a smooth gliding in special guide bars which are particularly broad and re-adjustable. These bars are fitted into the inside of the frame.

The packing of the pistons has been arranged by means of easily exchangeable packings or cups. The tightness achieved by this method is absolute. In order to avoid the transmission of heat to the upper table and cylinder as well as to the lower table the presses are furnished with special grooved face plates instead of the grooves being directly worked into the upper or lower table. Insulating plates have been inserted, moreover, between the face plates and the upper and lower table.

The presses are constructed as high-speed presses with accelerated return and an ample margin of safety has been allowed in the design. Pieron presses are, moreover, equipped with automatic stroke retardation in order to slow down the closing of the press at any place desired.

The discharge arrangement has been automatically coupled with the reversal and may be adjusted by means of tie rods the adjustment of which is easy and convenient. The discharge appliance may, moreover, be operated by hand by means of a cranked handle. Instead of this discharge appliance hydraulic discharge appliances are supplied, which are either governed by the upper table valve or have their own special valve.

The movement of the upper table is governed by a special valve which is fixed to the press at a convenient height and is operated by means of a hand lever.

In order to save power a power storage tank is supplied from which the cylinder may quickly be refilled, so that low-pressure water is no longer necessary.

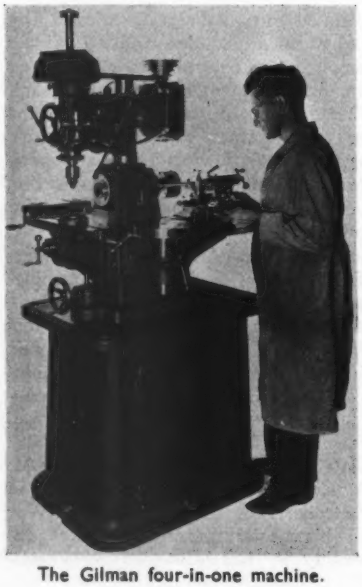
The main features of the new Pieron hydraulic upper-pressure high-speed presses are: high working speed, absolute reliability in working and a minimum cost of maintenance.

The increase of the working speed which has been achieved in the new construction requires no additional power. The presses make it therefore possible to attain a higher point of efficiency and profitableness in the mass production of pressed pieces. They are supplied with separate drive, group drive and central drive.

If the press is to be operated by a separate drive by means of a press pump it is possible to supply a hydraulic high-pressure pump of special design which works with a high degree of economic efficiency and is of a sturdy build. Pieron pumps are equipped with an automatic pressure regulation appliance which makes a finely graduated regulation of the pressure required for the different materials to be pressed possible. The pressure so adjusted remains constant throughout the period of pressing.

Four-in-one Toolroom Machine

Dowding and Doll, Ltd., Greycoat Street, Westminster, London, S.W.1, have sent us particulars of a combined machine tool incorporating a lathe unit, sensitive drill unit, horizontal milling unit and a vertical milling unit. The machine is manufactured by the Gilman Engineering Works, Janesville, Wisconsin, U.S.A., and Dowding and Doll, Ltd., have taken over the sole agency in this country.



The Gilman four-in-one machine.

Built to a sound and far-sighted basic design, the Gilman four-in-one toolroom machine takes full advantage of each new advance in modern machine tool progress. Compared with methods formerly used, it is more efficient, more versatile, and provides greater accuracy and economy. Not only does the machine embody the work capacity of four machines, but it also cuts down the investment entailed in a range of equipment, not to mention the savings in floor space. So versatile are its applications that it fits well into the production scheme of every plant, both large and small. The machine is easy to operate and may be used most effectively to secure low-cost production on many parts manufactured in small quantities; in fact, it often approaches the economies of special machinery without the high purchase price and large investment in tools and fixtures required for special machinery.

With this machine it is possible to complete all the operations on the work piece and so eliminate the necessity to transfer the work from one machine located in one part of the shop to another located in an entirely different section, thus saving valuable time and increasing the work capacity of the operator and machine. Dowding and Doll, Ltd., point out that the machine has been further improved. The top of the column is heavier, the milling table increased in width to 6 ins., the table surface has now three T slots instead of one and a selective gear speed transmission, furnishing 12 speed changes, has also been incorporated. The machine is equipped with No. 5 New Departure double roll bearings, which are the finest type made by New Departure Co.

There is many an engineering and especially mould-making and mould shop in the plastics industry where lack of adequate toolroom is felt as a severe disadvantage. It is especially for such firms that the machine will appeal. The tool is a precision machine in the pure sense of the word; it is very adaptable and takes up very little floor space.

Manufacturers interested in this new addition to Dowding and Doll's range of tool-making machines should write for further details.

Distinctive Moulded Closures, manufactured in opaque and translucent colours from all types of powder and injection mouldings, can be supplied from stock moulds or to suit customers' own requirements.

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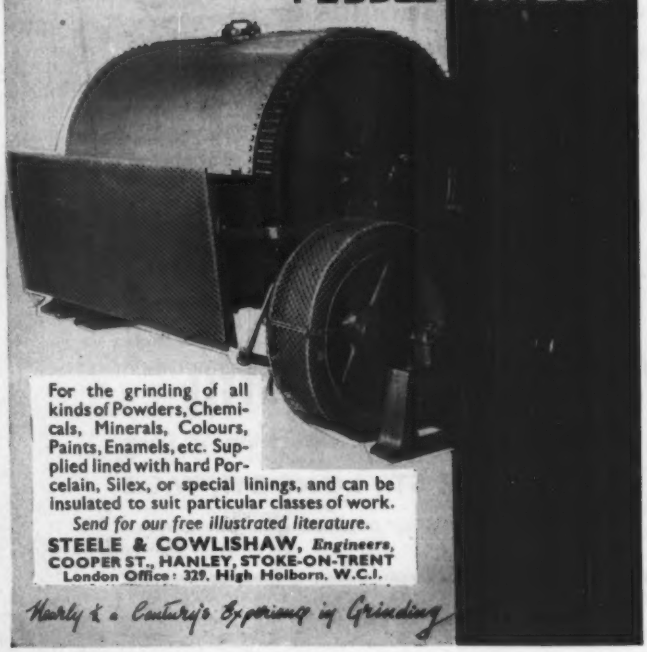

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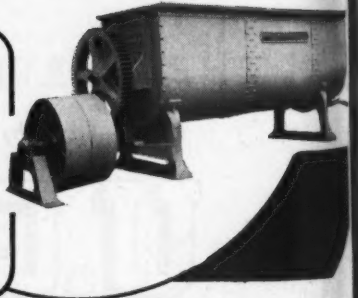

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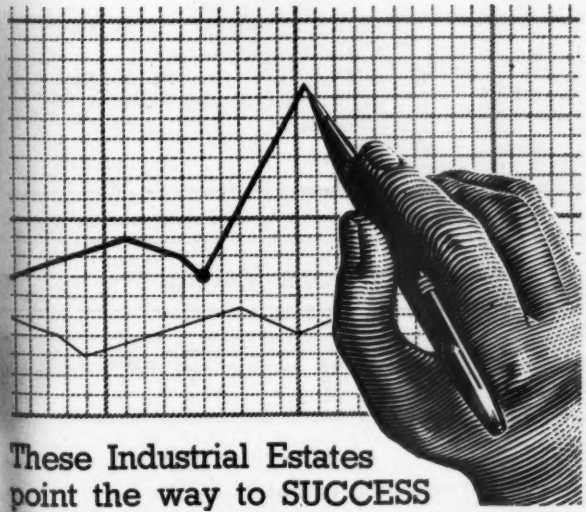

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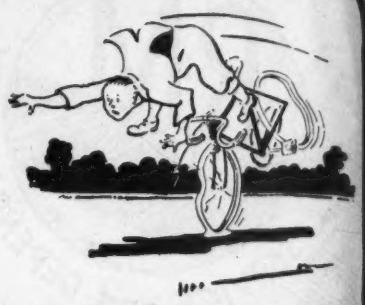

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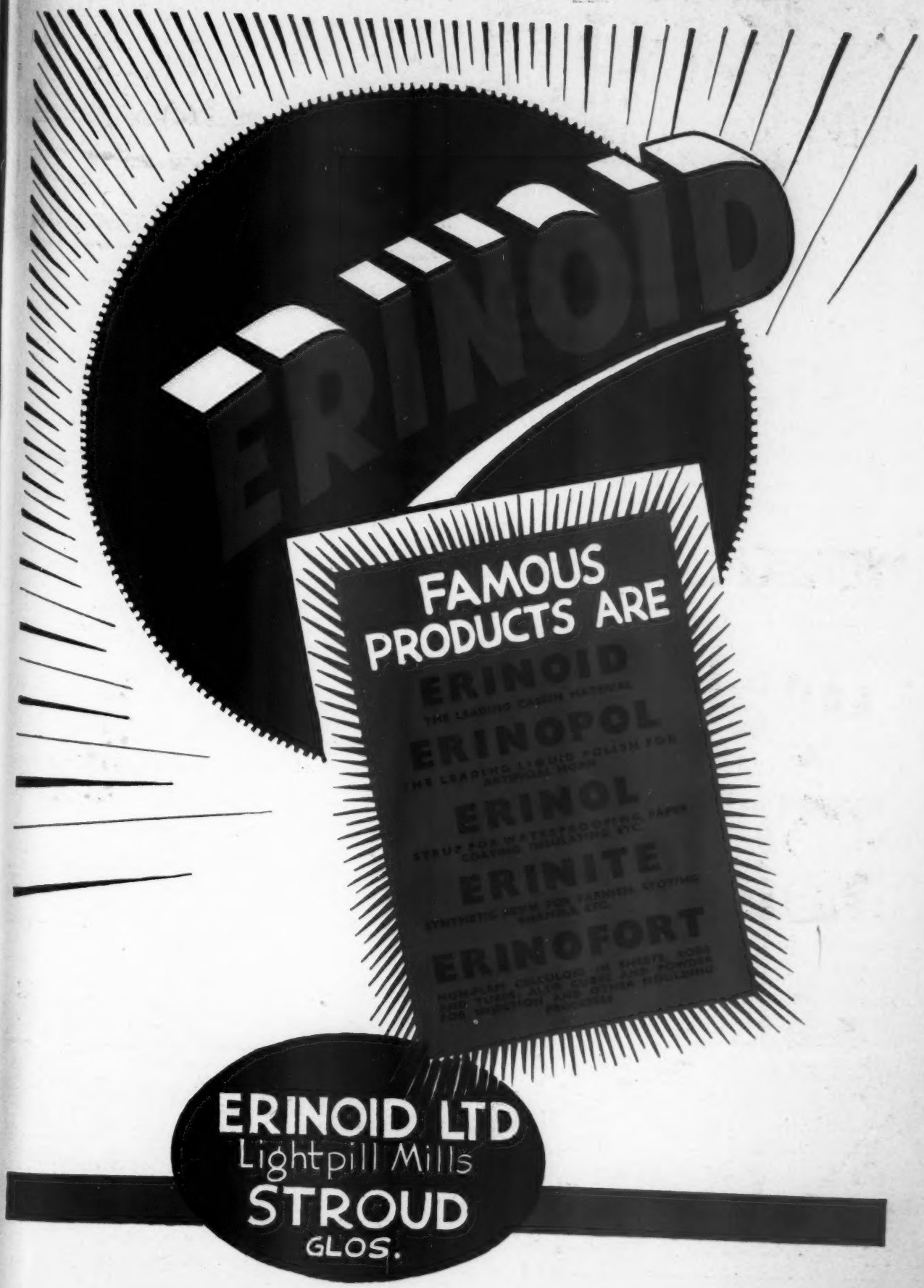
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